Proceedings

of a Workshop held
March 19 and 20, 1987
Hotel de la Chaudière,
Hull, Québec

Edited by:

H.P. Arai and

M.D.B. Burt

Science and Technology in Canadian Museums: A Neglected Heritage?

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SCIENCE AND TECHNOLOGY IN CANADIAN MUSEUMS:

A NEGLECTED HERITAGE?

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Published by
the Canadian Museum of Nature

Canadian
Museum
of Nature

Musée
canadien
de la nature

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Published by the:

Canadian Museum of Nature
Ottawa, Canada K1P 6P4

Available by mail order from:

Canadian Museum of Nature
Direct Mail Section
P.O. Box 3443, Station "D"
Ottawa, Canada K1P 6P4

Printed in Canada
ISBN 0-660-13068-8

Publié par le :

Musée canadien de la nature
Ottawa, Canada K1P 6P4

L'éditeur remplet les commandes postales adressées au :

Musée canadien de la nature
Section des commandes postales
C.P. 3443, succursale D
Ottawa, Canada K1P 6P4

Imprimé au Canada
ISBN 0-660-13068-8

CANADIAN CATALOGUING IN PUBLICATION DATA

Main entry under title:

Science and technology in Canadian museums: a neglected heritage? : proceedings of a workshop held March 19 and 20, 1987, Hotel de la Chaudière, Hull, P.Q.

Includes some articles in French.
ISBN 0-660-13068-8

1. Museums -- Canada -- Technological innovations -- Congresses.
2. Museum techniques -- Congresses.
I. Arai, Hisao P., 1926-
II. Burt, M. D. B. (Michael D. B.)
III. Canadian Museum of Nature.

AM2.S34 1993 069'0971 C93-099435-3

Library / Bibliothèque

APR 20 1993

Canadian Museum of Nature
Musée canadien de la nature

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The publication of these proceedings has been made possible through the support of the Canadian Museum of Nature and the late lamented Science Council of Canada.

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CONTENTS

page

FOREWORD vii

WELCOME AND INTRODUCTION TO THE WORKSHOP:
Jean-Pascal Souque, Director General, Public Programs, National Museum of Science and Technology, Ottawa. (Workshop Director and Facilitator) ix

KEYNOTE ADDRESS: R. Yorke Edwards, Retired Director, Royal Museum, Victoria, B.C. "Science and Technology in our Museums." 1

SESSION I. MUSEUM-BASED SCIENTIFIC ACTIVITY: POLICY

(Chairman: C.C. Lindsey)

Sharilyn J. Ingram, Deputy Director and Chief of Operations, Art Gallery of Ontario, Toronto. "The development of a museum research policy: the issues, some questions, and future possibilities." 14

Charles Farrar, Director, Le Musee du Seminaire, Sherbrooke, P.Q. "Le développement des collections scientifiques et technologiques au Québec" ou "L'absence complète de politique." 19

Lorin I. Nevling, Chief, Illinois Natural History Survey. "Preparing for the tomorrow that arrived yesterday." 23

T. Cuyler Young, Jr., Curator, West Asian Department, Royal Ontario Museum, Ontario. "Policies founded on effectiveness." 28

SESSION II. MUSEUM-BASED SCIENTIFIC ACTIVITY: PRACTICE

(Chairman: H.P. Arai)

I.R. Ball: (manuscript not available)

A. Emery, Director, Canadian Museum of Nature, Ottawa, Ontario. "Museum science: practices." 32

D.F. McAlpine, Curator, Science Department, The New Brunswick Museum, Saint John, N.B. "Regional museum-based science: survival in a marginal environment." 37

SESSION III. NATURAL SCIENCE COLLECTIONS IN MUSEUMS

(Chairman: M.D.B. Burt)

E.J. Crossman, Curator, Department Ichthyology and Herpetology, Royal Ontario Museum, Toronto, Ontario. "Natural history collections and museum science: image, mandate, and funding." 48

G.R. South, Director, Institute of Marine Resources, University of South Pacific, Suva, Fiji. "Canadian herbaria." 59

G.G.E. Scudder, Head, Department of Zoology, University of British Columbia, Vancouver, B.C. "Natural history collections in Canadian museums." 69

SESSION IV. OUR TECHNOLOGICAL HERITAGE: DEFINITION, CUSTODIANSHIP, AND INTERPRETATION

(Chairman: W. McGowan)

Paul Carle, Professor, Département de Communications, Université du Québec à Montréal. "La recherche sur une collection d'anciens instruments scientifiques: élements d'interpretation." 74

Paul Donahue, Director General, National Museum of Science and Technology. "What's new at the old bun factory?" 78

Louise Trottier, Curator, Energy, National Museum of Science and Technology, Ottawa. "Le patrimoine de l'industrie: un champ d'honneur ou d'oubli?" 85

SESSION V. SHARING KNOWLEDGE WITH THE PUBLIC: PROBLEMS, THEORY, AND PRACTICE

(Chairman: W. Case)

Jacques Desautels: (manuscript not available)

Leslie H. Patten, Museum Consultant, Leslie H. Patten and Associates, Toronto. "Introducing science to the arts of exhibition design." 92

T. Semadeni, Senior Scientist, Science North, Sudbury, Ontario. "Science North - a science museum with no collections." 96

SESSION VI. FINAL PLENARY

(Chairman, M.D.B. Burt)

Emlyn H. Koster, Director General, Ontario Science Center, Don Mills, Ontario. (Formerly Director, Royal Tyrrell Museum of Palaeontology in Drumheller, Alberta. "Summary of the workshop: thoughts for discussion." 102

RESOLUTION (unanimously approved). 106

POSTSCRIPT

Susan M. Woodward, Curatorial Assistant, Department of Mammalogy, Royal Ontario Museum, Toronto, Ontario. Report on the **First International Symposium on the Preservation and Conservation of Natural History Collections.** 109

Resolutions from the **First International Symposium on the Preservation and Conservation of Natural History Collections,** Madrid, Spain (May 10-15, 1992). 114

POST-POSTSCRIPT

G.G.E. Scudder, Department of Zoology, University of British Columbia, Vancouver, B.C. Resolution passed by a Joint Meeting of: Agriculture Canada, Forestry Canada, and the Canadian Museum of Nature in Ottawa, June 15-17, 1992. 121

FOREWORD

The materials presented here, under the label of "Proceedings" are the presentations made at a workshop entitled "Science and Technology in Canadian Museums: A Neglected Heritage?". The sessions were held in Hull, P.Q. on 19-20 March 1987 under the auspices of the Science Council of Canada and the Canadian Society of Zoologists.

The long delay in making this information public is due, among others, to:

1. a lack of decision as to the necessity of publication;

2. a change in personnel responsible for appropriate activity subsequent to the workshop;

3. a resolution of the question on the necessity for reciprocal translations into each of the official languages of each of the submissions, and

4. fiscal considerations.

The majority of the contributions are either typescripts submitted by the participants or are transcriptions from tapes recorded at each of the sessions. Most of what is being printed is verbatim or near verbatim, i.e. little or no editorial input was interjected. In some, however, the author has altered the original submission to compensate for changes in thought or to update the original.

The workshop itself was organized, and planned, single-handedly by Dr. Jean-Pascal Souque to whom we all owe a great debt of gratitude. Although the planning of the workshop started while he was still on the staff of the Science Council of Canada, by the time the workshop was actually held, he had already moved to his new position with the National Museum of Science and Technology in Ottawa. That he was able to organize such a highly successful venture at a doubly busy time is ample testimony to his remarkable capabilities. The most recent intervention and help of Dr. Leo Margolis, as President of the Canadian Society of Zoologists, and of Dr. Janet Halliwell, Chairman of Science Council of Canada, in rescuing these proceedings from extinction, must not go unrecorded. The help of the Canadian Museum of Nature, in making this publication possible, is also gratefully acknowledged.

The Science Council of Canada and the Canadian Society of Zoologists should be duly recognized for their respective roles in the publication of what we, as editors, feel are major concerns, in and important recommendations for, Canadian museology.

Although we, the undersigned, are responsible for these "proceedings", Dr. Casimir Lindsey of the University of British Columbia was one of the original initiators of the activity which culminated in the workshop.

Hisao P. Arai
University of Calgary

Michael D.B. Burt
University of New Brunswick

SCIENCE AND TECHNOLOGY IN CANADIAN MUSEUMS: A NEGLECTED HERITAGE

In opening the Workshop, Dr. Jean-Pascal Souque welcomed all participants and outlined the framework of the Meeting. He played a vital role in introducing all the Chairmen, before each session, and stimulating discussion following each presentation.

The above Title for the workshop, the proceedings of which are herein contained, was created by Dr. Souque to reflect the problems perceived by many with respect to our Museums. In addition to choosing the Title for the workshop, Dr. Souque also chose the speakers, organized the workshop, and facilitated the whole operation. As is abundantly clear from the many papers that are in the proceedings, concerns that were expressed by Dr. Souque and by the authors some five years ago are still concerns now. This is even more evident when we consider the Postscript to the Proceedings written by Dr. Susan Woodward and the Resolutions that were passed by the First International Symposium on the Preservation and Conservation of Natural History Collections.

KEYNOTE ADDRESS

R. Yorke Edwards: "Science and Technology in our Museums."

SCIENCE AND TECHNOLOGY IN OUR MUSEUMS

YORKE EDWARDS

I am honoured to be here, doing what I'm doing, and I also look forward to the next few days with you, examining a much misunderstood subject. As keynote speaker I would normally have the pleasant task of being general in my comments, thus avoiding the specifics assigned to others. Like the fan dancer's fan, I would reveal the general picture but not the more interesting details.

But with your permission, today I will be different. I want to begin by telling a rather detailed story. This tale will contain examples which will illustrate more general comments to follow. The theory here is that when I come to the necessary generalities, I will be able to skip through them with few asides, and so perhaps at a livelier pace.

A Tale of Stones

The scientist in this story (his name is Tom) is an archaeologist with a background in geology. He works on Canada's west coast where he manages a large archaeological collection consisting mainly of stone modified by man.

While Tom lives on the anthropologically rich west coast, he is notable for preferring to do his archaeological field work in the Boreal Forest, especially in the forested northwest corner of the Great Plains where a corridor between ice sheets might have existed, and might have enabled man to invade the America's from what is now the Canadian Arctic. Using tools he collected from near the Liard River, Tom tested some results reported from England in which scratches and other signs of wear on stone age tools were used to reveal the kinds of uses once given them. It seemed a long jump from scratches to uses, but a try was in order. For over a century the specific uses given these tools have been fertile areas for conjecture and sometimes for fictions masquerading as facts.

He soon found what seemed to be scratches, or at least marks of some sort. More magnification revealed not scratches, but the edges of something on the stone. More looking revealed that he had found the residue of a liquid which in a few cases showed where drops had run down from the edges and then dried, preserving both the drop and its path. More looking still, and he found red blood cells trapped in the residue. Eureka! Imagine it! Blood thousands of year old! New windows had opened into archaeological discovery, and into biological discovery as well. The sizes of those windows remain in question, but they appear to be very large.

Yorke Edwards

Given the micro-techniques now possible for carbon dating and analysing blood, there is a large amount of prehistoric blood in museum collections, a huge bank of information yet unread. In the British Columbia Provincial Museum, about 80 per cent of stone artifacts used for cutting have blood on them. Dried blood, it turns out, is amazingly durable. Tom has found it, apparently intact, on a 6000 year old artifact taken from podsolic soil typical of subarctic forest. Podsols are acid, ranging perhaps from pH3.5 to pH5. Bone lasts in such soils for only about 200 years.

The next question was, "Whose blood?" Entering a quite unfamiliar field, Tom learned how to crystalize out the haemoglobin. Each species has a different haemoglobin, so each haemoglobin therefore has a distinctive crystal. Identifying the blood by comparing crystal forms with others made from known sources, from zoo animals for instance, he found that most of the blood was human, but he found also caribou, moose, grizzly bear, mountain sheep, varying hare, squirrel of unknown species, and sea lion, not all of course from the Boreal Forest. The abundance of human blood was not necessarily a matter of murder or war, rather making cutting edges from stone is a bloody business, as Tom knew from experience. Good stone edges are much sharper than our best metal edges for surgery. The rock is shaped by pressing off flakes which are very sharp as well. Slips, cuts, and blood are the rule. Since many tools were made at traditional flaking sites near the sources of good stone, huge accumulations of chips in such places must harbour large amounts of preserved human blood.

Much of the story to this point is in Science for June 17, 1983.

For those not well informed about blood chemistry, like me, part of a later conference paper given by Tom helps to explain how the blood film is durably fixed. I paraphrase slightly:

> In the drying process of blood, serum albumen forms a polymer- (that is, the long protein molecules join to form even longer ones). Haemoglobin molecules that spilled into the serum albumen become entrapped in the forming polymer, and are like molecular meatballs in an albumen spaghetti. The polymer then acts to protect the haemoglobin from the immediate environment. Fine adherents of soil are also protective.

More recently Tom has used another way to identify the blood donors to species using electrophoresis, in which (and here I oversimplify) each kind of protein is induced to "draw" its own distinctive curve.

Plant residues are also found on the stones, and no doubt are sources

of palaeo-information also.

Looking ahead to other possibilities, old tools with old blood attached are about to tell stories to museum curators that were undreamed of when the tools were collected. Fascinating possibilities are emerging for obtaining palaeo-information on man and the other animals that he cut, information in the fields of biogeography, genetics pathology, immunology, epidemiology, nutrition, even climatology - information of many kinds reaching forward from the times of the continental icecap. At what age does dried blood cease to be useful? The last time I talked to Tom he had found quite normal looking dried blood on a stone tool dated at 10,000 years old. This stone was sent to him from the Middle East.

It is safe to say that most museum collections **of all kinds** have yet to reveal much of the information that they hold. Curators should therefore be very careful about how they treat their collections. Those collectors of stone tools who have used strong solvents, emulsifiers, or abrasives to clean collections to enhance their beauty, have quite probably destroyed the most valuable parts of their collections. They did it by thinking "aesthetics" without thinking "science" as well.

Here ends the story of blood on stone - and incidentally, the "Tom" in the story is Tom Loy of the British Columbia Provincial Museum in Victoria.

Understanding Museums

A major problem of museums, and especially of science in museums, is that most people have no understanding of them, or misunderstand them. At an early age, museums became part of my life as a user, and this persisted when I was employed in one. As a user and practicing biologist, I remember being amused by a story that came out of middle Canada. The new museum had been build in a prairie city, and the staff was working hard to fill the new public spaces with exhibits. A powerful official who had control over the destiny of that museum suddenly discovered its ongoing costs, especially the costly size of its staff. He investigated briefly, but relaxed after jumping to several confusions which convinced him that the situation was self-correcting. He was overheard explaining to his equally uninformed aids that as soon as the exhibits were all in place there would be no further need for the collections. The curators could then be fired, for their jobs would be done.

When I became director of a provincial museum, this story was too close to experience to be funny. Most government officials in high places did not know that the museum was science driven, and as the recession moved in I

seemed to be constantly defending the museum's research programs. The news that the mysterious thing called "science" was in the museum caused suspicious concern, but the word "research" brought outbursts about poor uses of priorities and funds. Research was "elitist, expensive, and a waste of money." "Elitist", incidentally, was used as if the museum had something like smallpox (nothing remotely related to what is in my dictionary). I could usually cool the heat with a careful little account on what museums are and what they must do, but with people coming and going frequently from jobs above me in a kind of management of management frenzy, I was regularly confronted by someone new and uninformed. It was enough to result in sticking pins into pictures of the Harvard Business School. In my defensive tactics, I began to use the word "science" as little as possible, and the word "research" not at all. That helped; but a little investigating reveals that it is not just Ministers of the Crown and the people around them that lack understanding of museums and what keeps them lively. Most people at cocktail parties have the same vacuum. Museums have simply done a sloppy job of revealing what they are. To most people a museum is "a bunch of exhibits" and not much else.

My own ideas on what a museum is and does are not necessarily the widely held norm, but I see the broad tasks of museums to be five in number, and the relation of these tasks, one to another, are best put on paper in the form of a cross, one task central, four tasks around it at the four main compass points.

Three of these goals follow one another horizontally in logical sequences:

to collect in order to have a collection;

to keep a collection in order to have information;

to communicate information to people.

The two remaining goals are then, top and bottom:

to preserve the collection;

to discover and record information about the collection.

In short, a museum is a collection. Essential to good collections are collecting, and conservation of the collection. The purpose of it all is the discovery and saving of information, which then is to be communicated to society's various audiences.

Looked at less formally, a museum is a data bank specializing in primary things, much of the data in the bank are in the realms of the sciences, discovery (including research) must continually add new information to the old, and the communication of information in various ways is the museum's "product". The last, when adequate, ensures the museum's survival.

Scientific information is the central concern of many museums, although it may be scarce in museums concentrating on recorded history. But in **all** vital museums **discovery** is present, whether through pursuing old information or seeking out new information in research activity. To quote from a recent publication: "A museum is a dead museum that does not have at least one good mind asking clever questions of objects in the collection, then working at answering those questions." A steady flow of new information is one of the two ingredients essential for sustaining public interest in the museum and in its future welfare. The other essential is information delivery in understandable ways that attract the museum's many audiences, entertain them, even delight them. These audiences range from pre-schoolers to retired adults, from the largely uneducated to those with several degrees, from those enthused by locomotives to those hooked on studying phytoplankton through their own microscopes.

The museum's success at discovering and delivering information to society is eventually reflected in the size of the museum's budget.

Museums use a bewildering array of delivery methods to reach people with information. I once listed the delivery methods in use. The list grew to hold over 40 different "voices" of the museum. To suggest the scope on that list, a random sample could contain: posters, packaged games for sale, lectures, books, internships, papers in learned journals, newsletters, and advanced lectures given to people seated on folding stools in front of exhibits.

As almost anyone can tell you, the most important communication method used by museums is the exhibit. Many even think that a museum is not much else, and this is in one way very wrong, and in another way a bit right, wrong because a museum has several thousand other functions, right in the sense that it is the exhibits that largely determine what people decide a museum is worth. Delight them in the exhibition halls and they will put money in the budget for the entire museum. The irony here is that the exhibit has an extremely limited capacity to deliver receivable information to most of us, because most of the information in an exhibit is embodied in the objects shown. All of us being poorly informed about almost everything, this leaves only a few experts who can "read" much from the objects in each exhibit. Speaking generally, we are all uninformed on matters outside our own daily round, and this includes scientists, of whom it has been said that

most scientists do not understand most scientists.

Natural Science in Museums

To focus now on natural history museums, from man's biased point of view perhaps the most important thing on Planet Earth is life. Not long ago man thought that man was most important, a predictable arrogance then. This view began to change when Darwin published, and the need of change has now been made more evident by the popular new view of the world showing that man is a product of ecosystems which support him.

Despite all this, biology has been called the unknown science. In museums, it has fared not quite so badly as physics and chemistry. The most numerous collections in museums are those historical, which probably outnumber all other kinds combined by at least twenty to one. Other kinds, in approximate order of decreasing collections abundance after history, are art, anthropology, geology, biology, technology, physics and chemistry.

In general, natural history has not done well, with notable exceptions of course. The reason is that, to the average person, most biological specimens on museum storage shelves are peculiar looking to downright revolting, while looking quite unlike the lively things they once were. In contrast, curators in history, art, anthropology, geology, and technology can carry handsome objects directly from storage shelf to glass case, there to catch the public eye. Given that the exhibit is the main lure used by museums to attract support, the handicapped condition of biology in the museum is evident. It follows that research into improving the appearance of specimens should be high priority for research endeavours in the museum. Perhaps the research values of biological specimens can also be improved in the process of making them look more natural.

To some degree, the zoo, the aquarium, and the scientific garden-on-display have done what museums were unable to do, for in these the live organism is shown alive, in depressing environments perhaps, but infinitely more attractive than dead and discoloured specimens. In some desperation to show something attractive, biology museums have turned to models, casts, and taxidermy, and to combining these in the ultimate deception, the diorama. These are artifacts, not the primary things that the innocent viewer might take them as, but they are better - it seems - than nothing at all, or than brown corpses representing silvery iridescent fish.

The great collections representing Earth's life are in museums, and the huge task of finding and describing Earth's several million kinds of life has been done largely in museums. About as many more kinds of life remain to

be found, and known. What on this unique green Earth could be more important than that? Museums have also lead in the field of biogeography, the science of what lives where. We are told that we will lose half of the world's presently undescribed organisms to extinction before we can even name them; it follows that we will probably lose most of the organisms now unmapped before their maps are even begun. There is much for museums to do, for no one else appears to be helping much.

Science, along with related scholarship in history, provides the productive machinery in museums. Using objects in the collection to tell their own stories, it is the purpose of the museum's scholars to accumulate known information about those objects, and to discover new information from them. What the museum says to the world is what the scholars on staff know about the collection. Discovery is the source of exciting new information in museums. Deprived of it, museums become just warehouses.

Discovery efforts in museums are properly oriented at understanding the collection. When this hunt for information is successful, the final act of the study is publication of results. This preserves new knowledge and informs others who may benefit. This is part of the code of science. To break it is to waste time and funds, letting results be lost.

Few people understand the role of publishing in the sciences. It rarely makes money, usually costs money, so is like our roads in this respect. Roads speed the flows of people and goods, and this favours commerce and public well being. Similarly, publishing discoveries in the sciences improves both commerce and public well being. Both roads and publications in science have costs quite inconsequential in comparison with their benefits to society. The two are not unrelated. A modern highway is possible today because of thousands of discoveries preserved in thousands of publications that were printed through the centuries. And most of those discoveries were made by people who had not the slightest idea that their discovery would assist road building. What I've said of roads can also be said of the vehicles that dash along them. An automobile is the bottom line of a huge list of past discoveries.

The current period of scarce dollars for low political priorities has dried up science publishing in museums. We are back to the misunderstood museum again. This nonsense about publishing chokes off the scientific voice of the museum, preventing completion of jobs which the museum's core people are employed to do. A comparable situation would be an organization that collects donated blood deciding to save money by not packaging and delivering their product. Logical cutbacks in spending begin with trimming off peripheral fat, not with damming back vital functions.

Another avenue of information delivery in museums has had problems. Recent decades have seen in museums the growth of what many call "education". This resulted from museums wishing to communicate to more people, and wanting to do it more effectively than core staff had the time and sometimes the talent to do. With some logic, teachers were hired to organize many new and growing communication programs, while planners and designers took over the old museum business of creating exhibits. Before these new professionals came on the scene, curators did most of the museum's communicating, understandably being more successful at communication with their professional peers than with other adults or with children. Clearly, the well informed curator had the greatest depth of appropriate knowledge, but in many cases his very specialization turned his communications into mysterious nonsense to the man in the street. There were exception of course. Some curators were, in the other extreme, public figures widely read in books and lionized in lecture halls.

The new arrangement seems to be better, but adjustment is needed. Educators and designers must have more science, and must have training in the roles of curators. The educator's training for the classroom, and the designer's for the art gallery, give only part of the background needed to speak for the curators. Even with much improvement, however there will always be some difficulty from a spokesman dedicated to reaching lay audiences with the curator's view of the expanding edge of his science. This is a damned if you do, and damned if you don't problem, because the curator's view must be used, but it must be communicated more often and more understandably than many curators are able to do.

For several decades the scientific information held by curators has been reaching some of the public partly filtered, and partly distorted. The need appears to be for far more **curatorial** educators and designers, and **educational** curators, hybrid specialists created in each case by brief and perhaps painful retraining. The result will pay off in better communications delivered more easily than today. I am optimistic about a cure, for museums have proven adaptable to major change through their history.

Museums have begun, in the last few decades, to ponder their total role in society. Public formal education, school style, from pre-school to the third degree, is of course here to stay. Museums, on the other hand, are glimpsing quite another potential. Currently they seem to be successful at playing about seven integrated public roles. As I see them at the moment, the museum is:

- part social club,

- part entertainment centre,
- part educational centre offering many opportunities,
- part data bank,
- part provider of exciting and meaningful experiences with people and things,
- part urban de-urbanizer, encouraging membership in the still largely non-urbanized world,
- & part personal discovery centre and friendly science outpost, saving and showing people's roots.

Museums seek high standards; they are fact driven, and they are uniquely adventuresome places to experience. In many ways museums are quite unparalleled in our society, especially perhaps in their daily efforts to communicate on the street about science.

Looking ahead as I conclude, the condition now appearing to limit total success in most museums is the lack of bait to attract, then hook, several potential museum audiences which are very large. Three such audiences are: the late "teens", the young marrieds, and slicing the population in another direction, the blue collar segment. But the bait is improving. If it continues, the knowledge of the sciences could finally get loose in the streets, and the scientific revolution would be complete.

Yorke Edwards

Some Related Publications

Alderson, W.T. and S.P. Low	1976	Interpretation of Historic Sites. American Association of State and Local History, Nashville
Edwards, R.Y.	1979	The unnatural natural history in museums. Gazette 12: 14-17. Canadian Museums Association.
	1980	The object's the thing. Pp. 1-5 in Heritage Interpretation: Making Interpretation Relevant. (W.D. Barkley, ed.) British Columbia Provincial Museum, Heritage Record 11.
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SESSION I

MUSEUM-BASED SCIENTIFIC ACTIVITY: POLICY

(Chairman: C.C. Lindsey)

Speakers:

Sharilyn J. Ingram: "The development of a museum research policy: the issues, some questions, and future possibilities."

Charles Farrar: "Le développement des collections scientifiques et technologiques au Québec" ou "l'absence complète de politique."

Lorin I. Nevling: "Preparing for the tomorrow that arrived yesterday."

T. Cuyler Young, Jr.: "Policies founded on effectiveness."

THE DEVELOPMENT OF A MUSEUM RESEARCH POLICY: THE ISSUES, SOME QUESTIONS, AND FUTURE POSSIBILITIES

Sharilyn J. Ingram

My remarks today will address two aspects of the development of research policies in museums: firstly, those problems that were actually encountered in the development of a research policy for the National Museums of Canada, for which I was responsible in 1986; and secondly, broader policy implications for the federal government.

To start with our internal exercise: I can categorize the problems that arose in the development of a Research Policy for the National Museums of Canada as consisting of two different types: one, attitudinal, and the second, substantive. I would not normally highlight the attitudinal issue, but I think it offers some insight into the situation of museum researchers within Canada. To describe the problem simplistically, some researchers resisted the establishment of any policy as an intrusion upon their domain. I think this stance - described variously as "fear and loathing of everyone and everything not within the research field", or extreme defensiveness and hostility - speaks to the way in which museum researchers can feel their very existence to be threatened these days.

To offer a brief historical overview: over the last twenty years or so (specifically since the announcement of the National Museum Policy), we have seen in Canada a much greater emphasis on the public programming activities of museums. Consequently, museum researchers felt bypassed and undervalued when dollars flowed in to other sections of the museum, leading to increased profile and power on the public programming side. In the 1980's there has been an assault from a different direction; as the resources have dried up, we have seen a much greater emphasis on management in the broadest sense. After having been threatened on the one hand by public programming activities, researchers now feel themselves threatened by emphasis on management, which, again in the stereotype, has nothing to do with research and is undertaken by people who are profoundly antithetical to researchers. The most recent emphasis (which can be seen as sort of a logical progression of both management and public programming) is on the catch word of the last few years, marketing; and that has been, I think, equally threatening to researchers. [At a time when museum researchers can feel that their work is under-valued within their own institution, when their resource base is drying up, and when they seem to be battered by continuing demands from various directions to either do things or to conform to yet another system which does not seem part of their commitment to research, one can understand that when it is announced that "we're going to develop a Research Policy for the National Museums of Canada", the researchers did not exactly

jump for joy].

However, the process of policy development was a fascinating transition to observe because at first the researchers who formed the working group to look at the policy area began by feeling it very much a threat. As they became more involved in the process and began to understand it better, a sort of rear-guard action took place in which the researchers began to believe that a policy statement would instead be their best defence against interference from all sorts of managerial or bureaucratic intrusions. Consequently, the Research Policy became an advocacy document for research within the National Museums of Canada.

A second aspect which I would characterize as attitudinal was the antipathy towards research which was non-discipline related. Again, it was interesting to observe that, on the one hand, intellectually it could be recognized that those areas of research which we would generally term museological in nature are necessary. The one aspect of museological research that was not challenged in any way was that of conservation, which is closely linked to collections and to the support of the disciplines themselves; however, museological research that dealt with visitors, with public programming, or with any type of exhibit research was not felt to be appropriate to be included within the Research Policy by the researchers themselves.

I have dwelt upon the issue of attitude because I think that the substantive issues that arose during the policy development process have to be considered with that background in mind.

I would consider that five issues arose during the policy development process. The first one I would identify is the lack of any agreed upon conceptual model as to what a museum is. If I could give you a few brief examples: There is one model which says that a museum deals with the generation of knowledge; therefore, research is the primary function of a museum, the collections serve as the means whereby a certain amount of knowledge is generated, and the communication function facilitates the dissemination of this knowledge. Conversely, there is another conceptual model which looks at the museum as an informal learning environment in which the interaction between user and information is the paramount characteristic and the driving force behind the institution. Obviously, two models which vary so significantly will interpret the place of research within the institution in a very different fashion. One of the issues that we did not resolve satisfactorily was the conceptual linkage of research to all other functions, given that there was no agreement on any sort of conceptual model for a museum.

The second major issue that we attempted to address within our research policy is the issue of self-directed versus institutionally-directed research. This was resolved by the establishment of a management process which allowed for some balancing of needs between self-directed and institutional research. If, on the one hand, the researchers felt that they no longer totally controlled their own destiny, similarly the management process established certain rules which meant that the direction of their work would not be subject to mere managerial whim. Both sides have to play by the rules; therefore, the policy was ultimately a good thing.

This is an area in which I think we reached a reasonable and workable compromise, but it is certainly an issue to which I would appreciate seeing greater study given within a museum context.

A third issue which proceeds naturally from the attempt to solve self-directed versus institutionally-directed research is the question of priorities. How do we decide which research is most important? In our own policy development process at the corporate level, we, in essence, evaded this issue by simply stating some general principles and then passing the responsibility for the definition of specific priorities down to the individual museum level. It is an approach which makes a great deal of sense in our situation, but it does not really serve to illuminate the process for other museums. The general guidelines that we set were that the areas of research shall be determined by the mandate of the National Museums of Canada. More specifically, in the curatorial area, this definition is determined by approval by the Board of Trustees of curatorial disciplines for each museum. This approval of discipline then serves as the framework within which each museum determines its own priorities for research. Such priorities have to be determined with full consideration given not only to internal factors but also to the external research environment. This, however, only addresses research in the curatorial area. The way in which priorities are defined for other areas of research, specifically museological, is much less well defined.

The fourth issue which is somewhat implicit within the discussion of all other issues is the question of how museum research is to be managed. After a great deal of to-ing and fro-ing on this subject, eventually the policy established a management system where each museum sets its own research objectives, then sets up a research advisory committee which reviews on a cyclical basis and recommends approved research projects. Each research project has an identified project manager, associated with it, who is accountable both through the normal management hierarchy of the museum and through peer review. To some extent, this recognizes practices already in effect, but it also offers a greater formalization of practices that have been

less well defined. To date this system as a system has not been operational for sufficient time to see whether or not it really does meet our collective needs, whether the researchers are satisfied that this is a supportive framework for their work and whether the accountable managers feel that this does ensure that their objectives for research projects are being satisfied. The subsidiary issue to management is the question of funding of research, which was addressed only by a general statement of principle that every effort should be made to provide adequate funding and support bases to research activities.

From looking at our own internal problems in developing a research policy, obviously it pointed us towards some issues which exist in the broader government context. If I can approach this from two ways: first of all, on the museums' side of the table, the last federal government policy statement relating to museums is that which was issued in 1972 as the National Museum Policy. It was a very forward thinking document for its time, emphasizing the need to share with the Canadian people the full richness of their cultural and scientific heritage and declaring that museums are the means of effecting this sharing. Characterized as "decentralization and democratization", this policy has certainly served us well, as witnessed by the dramatic growth in the Canadian museum community that has resulted. However, it was passed fifteen years ago, and it is in many ways an inadequate expression for the current time. Given the maturity of the Canadian museum community, I think a more sophisticated look at the interrelationship between the federal government and the people of Canada with regard to the preservation and sharing of our Canadian heritage is required.

There has been a fair amount of work done in this area over the past few years by the National Museums of Canada. A conceptual model has been developed and widely discussed within the museum community as a possible framework for the future policy. However, at this point any further developments are on hold until the government makes some decisions about the direction it wishes to go in in the area of museums. To give but one example of a significant omission in current government policy, there is no designation of responsibility for federal collections, whether resulting from certain legislative activities or from activities undertaken by other government departments. This lack of formal designation as a federal repository is a problem for, for example, the National Museum of Natural Sciences. A second example could be found within the National Museum of Science and Technology. As I believe has been mentioned in the background paper for this conference, this institution has no tradition of research in any quasi-academic sense. Yet, obviously, it is placed in a unique position to acquaint the people of Canada with the riches of our own scientific and technological traditions. Again, an articulation of this particular role would immeasurably strengthen

that Museum's ability to fulfil that function.

That statement, of course, brings me to the other broad thrust of government policy which concerns the significance of science and technology within Canadian culture. In order for museums to contribute fully, we need a policy context on both sides of the fence; we need it both in the sense of museum policy and in a sense of a science and technology policy that acknowledges the role of museums (as has recently been declared). I believe that a clear articulation of these two directions would then allow for a consequent improvement in the funding of research activities within museums. (As is well recognized right now in the sciences, museum activities are not eligible for funding by the government granting councils, and the usual route that museums take now to have some of their research funded is through cross appointments with universities.)

A final area to which I would look for greater government activity is in providing a research infrastructure within the particular area of museology. At this time, the research infrastructures that relate to disciplinary research have a long tradition; however, museology is a far younger area of study. I can point to two capacities that exist right now within the National Museums of Canada, which I think offer a potential for building a research infrastructure. The first is the existence of a Canadian Heritage Information Network, which is a computer network linking all the major museums in the country. Its original purpose was for the exchange of information about collections and consequently the management of collections; however, we now know that its capacities are much greater. It can provide access to an almost unlimited number of data bases. When this capacity is combined with the fact that at the National Museums of Canada Library we have the primary source of museological reference material in the country, it seems to me that we have the nucleus of what could be a disseminating research centre. If one were then to build upon that through cooperation with the various museums studies programmes, I think we would have a way to enhance research activities within the whole area of museology. If this conference serves to highlight not only the needs of the disciplinary research but also the need for museological research, you may give us the push necessary to see this possibility become a reality.

"Le développement des collections scientifiques et technologiques au Québec" ou "L'absence complète de politique"

Charles Farrar

Bonjour. J'ai intitulé ma courte présentation ainsi: "Le développement des collections scientifiques et technologiques au Québec" ou "L'absence complète de politique". Afin de débuter, je vais une courte introduction de notre institution et du rôle que je joue au centre de cette institution. Alors, le Musée du Séminaire de Sherbrooke est un Musée centenaire, situé dans un établissement d'enseignement privé, un établissement d'enseignement pour le secondaire et le collégial. Depuis plus de cent ans, le Séminaire de Sherbrooke accumule des collections, principalement dans le domaine des sciences naturelles et aussi que dans les domaines de l'histoire et du patrimoine. Notre musée est donc privé. Il est géré par une corporation à but non lucratif. Il fait parti du réseau québécois des musées et centres d'exposition qui sont subventionnés en parti par Le Ministère des Affaires culturelles du Québec. Nous administrons aussi un centre d'exposition, moderne, bien équipé, qui est reconnu nationalement pour présenter des expositions itinérantes, provenant des musées à travers le pays et nous présentons nos propres productions, nos propres expositions de science naturelle. Certaines de nos expositions ont voyagé à travers le pays et actuellement notre exposition sur le espèces menacées d'extinction fait la grande tournée nationale de trois ans. Notre collection est ancienne, et regroupe près de cent milles pièces et spécimens de collection dont plus de 60% touchent directement au secteur des sciences naturelles. Bien qu'étant biologiste de formation, je ne peux affirmer que jexerce ma profession au musée , on me qualifie ni de chercheur ni de conservateur ni de concepteur d'exposition ou "designer" ni de technicien ni d'éducateur mais un peu de toutes ces fonctions à la fois, une après l'autre ou tout ensemble. Comme plusieurs de mes collègues qui oeuvrent dans les réseaux des musées du québec, nous nous retrouvons dans cette situation où, par manque de fonds et de structure, nous devons accumuler plusieurs tâches. Et cette situation est encore plus dramatique, si on le veut, dans le secteur des musées scientifiques ou technologiques du Québec. Actuellement, nous retrouvons trois musées d'état, trois importants musées, deux sont en Art, c'est-à-dire le Musée du Québec et le Musée d'art contemporain et bientôt nous verrons un nouveau musée en ethnologie - le Musée de la civilisation qui verra le jour au Québec. En plus, on peut ajoute un de les plus importants de nos musées qui est le Musée des beaux arts de Montréal. Alors, en plus de ces importants musées, on retrouve un réseau des musées et centres d'exposition privés qui regroupent près de 70 institutions. Plus de la moitié de celles-ci sont dans le domaine de l'art, les autres touchent surtout l'ethnologie, le patrimoine, et quelques exceptions represente le domaine des sciences. On peut parler du Musée du Séminaire de Sherbrooke et de Quebèc on peut parler de Redpath, il y a l'autres collections scientifiques, à la Pocatière, à Sept-Iles il y a naturellement d'autres importantes

collections scientifiques dans des autres musées mais qui sont peu ou pas exploitées. La plupart des collections scientifiques se retrouvent aussi dans les départements gouvernementaux du Ministère des loisirs, de la chasse et de la pêche. Comment se fait-il que il y a eu un développement des musées au québec et que on a jamais assisté au développement des musées scientifiques ou technologiques dans notre province? Pourquoi sommes-nous dans les seules provinces à avoir aucune institution bien équipée et bien structurée dans le domaine des sciences naturelles ou de la technologie? Je crois que c'est simplement par l'absence complète de politique de développement des musées au québec et par un certain désintéressement des sciences fondamentales taxinomiques et systématiques. Les musées au québec se sont développés selon les modes, selon les influences politiques et l'intérêt des administrateurs qui en avaient la garde. Voyons un exemple concret. Je parle des collections nationales de science naturelle du Québec. Suivons rapidement son cheminement au cours des ans. Jadis, ces collections ont été exposées dans les édifices qui abritent aujourd'hui le Musée du québec à Québec. Il y a plus d'une vingtaine d'années, par besoin d'espace d'exposition et d'entreposage pour les collections artistiques, ces collections furent réorientées et dispersées à travers diverses institutions ou simplement entreposées jusqu'à ce qu'il y ait un certain développement. Certaines universités dont Laval ont récupéré la collection géologique et une partie de la collection éthologique. Le reste a été entreposé on sait où jusqu'au jour, ou en 1981, devant la nécessité de libérer une école désaffectée qui devait être détruite, on appelle à Sherbrooke et on demande de venir récupérer rapidement ce qui reste de ces pauvres collections. Alors un inventaire rapide a été effectué par le Dr. Pierre Dansereau pour permettre de déterminer la qualité de cette vaste collection. Le trois-quarts de ces collections ont été détruite ou orientes dans des autres institutions principalement dans le secteur des loisirs scientifiques. Ce qui en reste, ou ce qui en restait, ont été emballees rapidement dans des boites de carton et envoyé à Sherbrooke. On avait après à ce moment qu'un jeune biologiste venait d'entrer en fonction dans les musées privés et que le domaine des sciences naturelles était fortement à demande et pourrait se développer à Sherbrooke. Alors, nous sommes allées chercher ces collections, qui sont toujours entreposées dans nos locaux, toujours dans les mêmes boîtes de carton. Nous avons dû, d'ailleurs, défrayé les coûts de transport pour la localisation de ces collections. Quels autres collections scientifiques dans les collèges et universités québécoises? quelle est le potentielle et où sont ces collections scientifiques qu'on retrouve dans les divers musées du Québec et ministères? Où sont les collections technologiques qui ramassent, est ce que l'on en a fait et quelle est leur potentiel? A peu près personne ne le sait à l'heure actuelle, mais une chose sur sûre, c'est que ces collections se dégrade rapidement et que les précieuses informations scientifiques qui s/y rattachent vont se perdre à tout jamais. L'ensemble de ces collections n'est ni connu ni exploité depuis plusieurs décennies. Ce portrait vous semble dramatique, mais il correspond à une certaine réalité quotidienne que l'on a dans les musées scientifiques au

Québec. Le problème c'est que nous n'avons ni le moyen de changer cette réalité ni le moyen de communiquer pour faire connaitre ce problème à la population et à la communauté scientifique et, surtout aux politiciens, qui changent assez rapidement ces années-ci. Sans chercher dans ce court laps de temps à trouver le pourquoi de cette situation des musées scientifiques au Québec, nous avons tout de même a se questionner. Depuis quelques années, on parle du projet de création d'une maison des sciences et techniques à Montréal, qui sera le centre d'excellence de diffusion de la culture scientifique et technologique Québécoise et sera un des piliers importants du développement des collections de la science et de la technologie au québec. Toutefois ce projet est maintenant relégué aux oubliettes, le personnel a été démantelé et les budgets ne sont pas disponibles pour la création de cet important musée scientifique. Un autre exemple concret est qui nous travaillons depuis plus de cinq ans, au développement d'un concept pour créer à Sherbrooke une infrastructure en science naturelle modernes, ce qui nous permettra d'avoir les équipements pour conserver nos collections et pour les connaitre et pour développer des politiques de collectionnement et de recherche. Depuis plus de cinq ans, nous frappons à la porte des instances gouvernementales sans obtenir de réalisation. Une étude de faisabilité a été complétée en janvier dernier et est actuellement à l'étude et la semaine dernière j'ai rencontré le cocus du parti libéral au sujet de notre projet. Ce projet était de 7 million$ va permettre d'obtenir le minimum d'équipement pour entreposer et pour développer des expositions modernes en science naturelle à Sherbrooke. La première chose qu'on nous a demandé c'était de couper de moitié les immobilisations nécessaires pour la realisation du musée. De regarder si une localisation avec un Musée de beaux arts à Sherbrooke, et un musée de patrimoine pouvaient etre possible sous un même toit. Trois volets qui, à mon avis, sont complètement différents. Alors, le dossier est toujours à l'étude. Ce musée pourrait régler une partie problème des collections scientifiques au Québec, mais il pourrait sans doute consituer qu'une partie du développement des sciences naturelles.

Soyons tout de même positif, nous poursuivons, toutefois, dans le réseau des musées au Québec, des activités courantes, intéressantes, innovatrices, dans le secteur scientifique et dans les autres secteurs. Il n'y a pas encore dans le domaine scientifique d'activité de recherche ni de collectionnement, qui s'effectue, mais notre musée est quand même actif sur le plan de la diffusion. Notre musée traditionnel est accessible, nous avons une production d'expositions temporaires et itinérantes qui augmentent d'année en année, nous offrôn une série de trousses éducatives pour les milieux scolaires et nos programmes éducatifs en sciences sont de plus en plus appréciés et demandés. Je crois aussi que ces activités d'actualité se fond àla grandeur du réseau et qu'il y a un potentiel intéressant de développement pour le muséologie au Québec. Quels sont les besoins urgents pour les musées scientifiques au Québec. Pour le moment, il y a un besoin urgent d'équipement à travers l'ensemble du réseau pour conserver et exploiter nos collections. Des efforts doivent etre faites pour faire un

inventaire exhaustif des collections et de leur potentiel afin de regrouper ce qui peut l'être où, au moins, de connaitre les potentiels de ces collections disséminées à travers de la province. Il y a un urgent besoin, aussi de permanence au niveau des conservateurs. Les budgets actuels ne permettent aucune main d'oeuvre a la conservation dans le domaine des collections scientifiques. Alors les programmes devraient tenir compte d'une certaine permanence de chercheurs pour développer ces collections et en exploiter leur contenu. Les programmes de recherche taxinomique et systématique devraient débutés le plus tôt possible dans nos musées et je crois que des programmes de recherche pour les secteurs des musées devraient se faire avec la collaboration des chercheurs universitaires afin de développer les programmes d'importance. La communauté scientifique doit être concertée, dans une certaine mesure, afin de faire connaitre notre travail et l'importance aussi du rôle de la recherche et du collectionnement comme base de l'ensemble de l'activité muséologique. Et surtout, il faut faire connaitre ce travail et cette importance à nos élus afin de pouvoir les sensibiliser aux rôles que nous jouons. Je crois essentiellement à ce potentiel, je crois à la mission de conservation et de recherche pour les musées aux pays et je suis convaincu que notre potentiel et l'intérêt pour le public est une cause importante et que nous devons être optimistes pour le futur.

PREPARING FOR THE TOMORROW THAT ARRIVED YESTERDAY

Lorin I. Nevling

I. Model of work flow in a research museum

A. Collections

B. Staffing
   a. Joint University appointments

C. Funding
   a. Governmental support for collections
   b. Governmental support for research

D. Facilities

E. Research output
   a. Publication
   b. Technology transfer vs. accessibility

F. Relationship among research/exhibition/education

G. Exhibition

H. Education

II. Collection data

A. An example of the integration of diverse data sets
B. New policy needs

III. Funding revisited

Lorin I. Nevling

1. Cinquain

2. Flow chart

3. FM-collection/ staff/ funding–Note that 73% of budget is for salaries and fringe benefits.

4. Five-year growth (The Systematics Community–ASC)

   The data presented here are drawn from "The Systematics Community", a survey undertaken by the Association of Systematics Collections. The survey covered 1,142 collections containing 191,000,000 specimens. It is clear that there is not enough space, staff, or finances for unbridled growth. A major policy decision is required to set growth priorities. There is a very disturbing trend within the U.S. for universities to give up their collections. These endangered collections are most often salvaged by museums and add significantly to the growth problem.

5. Survey–collection/ staff/ funding

   This is a different sort of organization than we saw previously because it has both basic and applied research units. It does show one of the effects of joint university appointments. If promotions and salaries are controlled by an academic department, the loyalty to the museum is secondary. In this case, it also shows a financial impact because grant proposals are submitted through the academic department. It is my understanding that Canadian scientists must compete for research funds only through academic departments. It seems to me that the idea of any grant system should be to support the best science whether it be in an academic department or in a museum. One of your highest priorities should be to induce whatever changes are necessary to permit museum-based researchers to compete for research funds.

6. Collection funding–BRRP of NSF

   For some time, there has been a program within the National Science Foundation, the Biological Research Resources Program, designed to assist in the ongoing support of major collections. It is a competitive program based, in part, on a net lender philosophy. The 1986 budget was 3.9 million dollars; the '87 budget is 5 million dollars. It is helpful but not sufficient to meet current needs.

7. Equipment available (from the Systematics Community)

8. Collection-related services

Lorin I. Nevling

9. Flow chart

   Museums seem to enjoy two separate and distinct reputations. One is based on research and is often worldwide, and the other is based on exhibition and education and is usually local.

10. Information flow–technology transfer vs. accessibility

    Part of the whole technology transfer/ accessibility issue is scientific publication. In my opinion, research includes by its very definition, publication. Therefore, it is important that adequate outlets and finances are available for this core activity.

11. Funding of programmatic activities

12. Exhibit Team structure

13. Flow chart

14. Rice rats

    I would like to show an example of a distribution problem in rice rats. Normally, we think of biological data being associated with the leg of a dead specimen.

15. Computer operator

    The problem has changed significantly because of machines and the integration of data from collections with other databases.

16. Plotter

17. Main frames

18. Illinois–study area highlighted

19. Study area

20. Targeting for close up

21. Close up

Lorin I. Nevling

From now on, I want you to imagine that you are looking at time-lapse photography from a computer screen.

22. Adding streams

23. Adding bottomland forest

24. Adding topography

25. Water/bottomland/topography/floodplain

By adding information from other than specimen-oriented databases, we can develop a fair idea of the habitat of the rice rat. There seems to be other appropriate habitat but lacking specimen confirmation. Do we have good distributional information? Let's add a few other things.

26. Roads

27. Roads/Railways

28. Conclusion mapping distribution of mammologists!

This whole use of integrated databases raises some fundamental policy questions to accommodate the new technology.

Who can enter data?

Who can change data entered previously?

Who has access to data?

Entering data into a system is an expensive undertaking; do you charge a fee for the use of data?

What nomenclatural system is to be used?

How is the data to be archived?

Is it now necessary to archive the software to access the archived data?

Should hardware and software be standardized for museums? If so, who decides.

Lorin I. Nevling

The machine age is a reality, and I suspect none of us have prepared adequately for it.

29. PRICE

In the final analysis, those activities that add up to a museum cost money and a lot of it, but it is among the best buys a nation can make.

30. Final slide: Funding

31. END

POLICIES FOUNDED ON EFFECTIVENESS

T. Cuyler Young, Jr.

The title of my remarks this morning is "Policies Founded on Effectiveness". I get this topic from two sentences in the conference briefing paper; two sentences which caught my eye. The first, on page 21, reads: "Should we be satisfied only with the large attendance at science and technology museums and centres regardless of the quality or the significance of that which experienced by the visitors?" Now, I think if we took the crustiest, most difficult and most recalcitrant natural science curator and asked him if he would be content if no one came to see galleries, even he would admit he would be disappointed. Obviously people have to come to a museum and see an exhibit in order to experience the work and the understanding and knowledge that has been developed by that crusty old curator.

But the critical question, it seems to me, is: How many people have to come for the museum to be effective? There is a growing dangerous tendency, at least in Canadian museums where we get somewhere between 80 and 90 percent of our funding from governments, for all of us in the museum, not just members of the Board of Trustees, to pay an inordinate amount of attention to the number of people who come through the turnstiles of the museum. There is an enormous tendency to measure our success as institutions in terms of the numbers of people we reach. This affects my life in a very practical way. I am constantly having to calm down members of Board of Trustees of the Royal Ontario Museum by pointing out to them that the attendance figures are probably not as large as Programmes and Public Relations make them out to be; that perhaps, if we are going to go public with those numbers, we should be a little careful about them, and perhaps trim them by 20 percent. This is a difficult argument to get across to a gung-ho member of the board because, if you have 938,000 people through the turnstiles this year, the natural tendency is to say: We had a million visitors. But to say in these circumstances that we had a million visitors is an incorrect and improper statement.

But the temptation to take 938,000 and round it to a million is enormous, and the reasons for that are absolutely clear. Our masters are politicians, and politicians succeed by playing number games. Head counts are vitally important to politicians. They would certainly be vitally important to me were I a politician, and I do not wish for a moment to knock the politicians, or to put them down in any way, for their interest in numbers. However, when they insist on taking their number games and transferring them into my world, then I get upset. No! Actually that is not true. I do not get upset at the politicians trying to transfer their number games into my world. What I get upset about

sometimes is people in my world – the museum world – agreeing to play the politicians' game. I should not, in fact, fault the politicians for wanting to transfer their ways of measuring things into my world. The people I should fault are the people in my world who accept that that world can be measured and dealt with by those kinds of number games.

Now the more times mentally that you take 938,000 and round it up to a million, the more times you will distort at the budget time the ideal pie chart dividing the museum's resources amongst its various functions. And you will do exactly what the previous speaker said you should not do: you will take away from x (say, collections development) to feed y (say, public programmes), because almost inevitably you are living in a situation where there is not any more coming into the pie. And I think this is the basic reason why (as was remarked earlier) we have gone through a decade of a shift of resources from research, curatorial activity, collections development and collection maintenance into public programmes and the like. And it is one of the reasons why we are sometimes so nervous when people talk about developing research policies and managing research, collections management and collection development in museums. Such moves are perceived as just another way to skim off scarce resources into the numbers game. What happens if you are constantly playing the game and rounding 938,000 up to a million is a gradual shift of resource emphasis in the institution and, therefore, the slow change in the nature of the institution.

Now, I would like to go back to a quote in our briefing paper on page 19 where it says:

> "To teach does not need to be taken literally. In this context, to teach means simply to design and implement a strategy aimed at changing something in the mental structure of the individual in order to have this particular individual build some new knowledge, facts, ideas, theories and models, but also attitudes or skills, directly related to science and technology."

Now, if we took that as a purpose for a museum, and if we asked for a policy that supported that purpose, then we would have a policy the success of which would not (could not) be measured in simple numbers. It's success should be measured some how, but here I confess to failure in my thinking because I do not know how it would be done. One of the things I would like this workshop to address over the next day and a half is: What possible mechanisms might there be for having a measurable policy on museums based on effectiveness rather than on the number of clicks in the turnstile? In thinking about measuring effectiveness under such a policy the furthest I got

down the road was a very short distance indeed. I went back and looked up (or tried to look up - I could not find exact numbers) what the original print runs were for Darwin's The Origin of the Species and Marx's Das Kapital. I thought perhaps these two books could be singled out as having been relatively effective in the history of the 19th and 20th centuries. I was not able to get accurate figures in the time available, but I was able to establish that the initial printings were very small in both cases, probably smaller that the initial printings of a scientific publication in a natural history museum today. And yet I think both publications were effective.

So what I would plead for, to sum up, is a policy – a political policy – that enables us to measure our effectiveness as museums: a policy that would satisfy our paymasters but would measure our effectiveness in terms of the way in which we bend the minds of the people who come to our museums and not in terms of the number of people who click through the turnstile. Thank you.

SESSION II

MUSEUM-BASED SCIENTIFIC ACTIVITY: PRACTICE

(Chairman: H.P. Arai)

Speakers:

I.R. Ball: Manauscript not available.

A. Emery: "Museum science: practices."

D.F. McAlpine: "Regional museum-based science: survival in a marginal environment."

MUSEUM SCIENCE: PRACTICES

A. Emery

Mankind has always been, and probably always will be interested in describing the universe around him. The scale of the universe, the method of description, and the use to which that description is put has always and probably always will vary, but the fact remains we want to know who we are, what we are, where we came from and where we are going. I, like everyone else also want to know why.

Through time, the why has been the subject of much speculation. The scientific method is simply a more formal method of acquiring the information so that we may eventually be able to deduce the why. The first task of science in describing the universe is to answer the question: "What does our universe contain?" In modern historical times, the age of the encyclopedists, who attempted to describe and catalogue everything in the world and in the skies, ended in the early 1900's for most of the sciences.

The next question was: "How does it all work?" By the 1950's most people took as fact, that the world had been explored and we knew pretty well all of the minerals, plant and animals. By the 1960's there was already a shift away from cataloguing nature to attempting to find out how everything worked. What are the mechanisms? The roots of mechanistic sciences like ethology, ecology, physiology, (in biology); vulcanology, petrology, and tectonics (in earth sciences), were established and the rush of discoveries in these previously unexplored intellectual areas is still going on today. These are exciting frontiers of knowledge. Often the discoveries in one of these "how-does-it-work-sciences" can give rise to another new science. In short the study of mechanisms of nature today is far more likely to reveal greater insight than the study of what the universe contains.

But wait. Is it true that the universe is sufficiently known that these new sciences can proceed alone indefinitely? In biology the discovery and naming of a species is called alpha taxonomy. How are we doing in alphataxonomy today? I should be able to report that virtually all species are known, otherwise it would truly be impossible to discover how the universe works.

The number of species of minerals amounts to only about 3,500, yet every year another dozen or two are described.

In botany, the number of new species described each year is in the hundreds, and estimates of the number of unknowns in the tropical areas of the world ranges up to 20 or 30% of the species in some groups.

In zoology, the situation is dramatic. Recent research suggests nearly 90% of the world's

insect fauna is still unknown. The still relatively common discovery of entirely new major animal groups even Phyla occasionally is a further indication of the mire of ignorance in which we still flounder.

So, it is just not true that the universe, macroscopic or microscopic has been described even to the extent of what it contains.

Modern synthesis sciences have been built on the foundation of a description of what the universe contains. When models of behaviour, evolution, tectonics, ecology, medicine, etc. fail, it is usually because the model has not accounted for all of the parts. We will never be able to predict in ecology the effect of stress or other factors until we know what comprises the ecosystem. In the tropics where some 80% of the world's diversity resides, we probably know only about 10% of the species. It is pretty hard to build a model when key parts are invisible.

Taxonomy and the understanding of the relationship between the species is the platform from which all the younger sciences operate. If the foundation is weak, "the house, she will fall."

How strong are we in the practice of taxonomy and systematics? These are the sciences that require the establishment and maintenance of long term collections, usually in a museum setting, or at least with access to a museum collection.

A scientist in this field begins by being interested in nature: a survey of biologists, made by the ASC suggested that an enormous majority of us had made up our minds by the time we were 10 years old. Training to a competent scientist level is carried out in universities, and with minor exceptions includes getting a Ph.D.

A survey carried out by Dr. Donald Chant, revealed that in Canada, there are very few universities that offer courses that even include whole animals or plants. There are almost none that offer courses in taxonomy unless there is a major museum either as a part of the university or close by. And in most cases, the courses are taught by the museum staff, not the university professors. In the last two decades, universities have been emphasizing the younger sciences, and recognizing the greater potential for discovery in these areas, find the museum collections a major drain on resources. They have therefore been divesting themselves of these as fast as possible. This creates a kind of vicious circle in which the deemphasis of taxonomy leads to a greater emphasis on the other sciences, so that students are drawn away from taxonomy. Today we are at the second generation of the cycle, and find that even if you want to study taxonomy, Canada's ability to provide instruction is severely limited. The next generation of scientists will be even less capable, so still fewer

students will be trained.

In fact, most institutions that want to hire collection-oriented scientists now have enormous difficulty finding a qualified Canadian. Most have to appeal to other countries. Canada is in a very dangerous position. She will soon have no capacity to support the "how does it work" sciences in which she has invested so heavily, because she fails to provide training in the fundamental sciences.

Once trained, what does a museum scientist do? He must have basic tools and facilities to preserve and keep the materials that form the basis of the collection. At least for the various kinds of Type specimens, there should be a commitment to keep them forever. Most countries, even the most backward of third world countries have a policy that the Type specimens of their own species should stay in their country, to form the basis of knowledge of their own resources. Except for a few, the countries of the world define a mandate for some institution in the country to be responsible for the maintenance of that heritage.

Canada is not a third world country; it is well developed, rich in resources, and well respected in some of its sciences. It should be to Canada's intense embarrassment internationally, that she does not protect her Type material, does not define an institution that must be responsible for its heritage, and provides no access to financial support for the maintenance of permanent collections. More unsettling than that; apparently the leaders of our country do not know the danger this presents to the country's continued welfare.

When requesting support for collections from the federal system, the logic of responses we at the Canadian Museum of Nature (CMN) get, even from trained analysts in the Treasury Board leaves us gasping at the abyss of ignorance that separates our system from protecting our country's heritage assets and understanding the world's biota. When a museum scientist, other than a university professor, searches for a place in the federal system to get money to support collections, they fare even worse than we do: there is absolutely no access, because there is no policy to support it. There is no federal support for museums collections.

Amazingly, Canada does have some natural history collections of a world class. How did they get here? Most of the collections are either still in universities, and thus ultimately doomed if the system continues as it has, or in provincially or locally supported museums. The CMN is the single natural history museum that has access to federal money to support basic research in taxonomy as a museum. The Biosystematics Institute at Agriculture Canada holds major collections but, by its mandate, is project oriented, thus the collections are vulnerable. CMN has about 35 professional and para-professionals who do at least some research and collection work. The budget for the academic aspects of the museum are

mainly on simple maintenance of the collections. There is precious little spent on the actual systematic research we need so badly. Yet if we cut into our public programmes too much, we disappear from public view and our support would completely dry up.

What about the research that goes into taxonomy and the development of collections. Once again, except for the CMN, the federal policy specifically excludes, denies access to, all museum natural history scientists (except, as I mentioned, those who happen as well to be university professors). That support is getting harder to find as the universities turn away from fundamental sciences like taxonomy, systematics, and evolution. In Canada today, the museum natural scientist goes to the provinces, or to the private sector, or to his own pocket to support his research. That is a national disgrace. Often the researcher in Canada turns to other countries to find support. In my case, before I became Director here at the CMN, I was able to get funding from Britain, the United States, and Australia as well as Canada. This is nice, but unlikely to continue and a sign of desperation.

The evidence to support the contention that we are weak in taxonomy and systematics, the support sciences for the younger sciences, is not hard to locate. First, the only centres of taxonomic strength in Canada are in Toronto, Ottawa, and perhaps Vancouver/ Victoria. Not much for a country like ours. Even these centres are not particularly strong, and weakening in the face changing university priorities. Another indicator is to assess the average age of the taxonomic scientist. At the CMN 50% of our scientists will be at retirement age in the next 10 or so years. The ROM and UofT are in essentially the same position, though they were a little ahead of us, and have had to start searching for scientists already.

Ladies and gentlemen, we are in serious trouble.

I recommend the following as remedies, to be carried out at the federal level:

Policy

1) Establish laws to safeguard at least our Type collections and specific reference materials that have come from baseline inventories and impact studies. This could be done by designating the CMN as the national repository for all federal collections (as in the US); by designating specific museums in the country as repositories of types and voucher specimens, and by requiring the inclusion of financial support for housing specimens in impact studies. (This would be for specific periods of time.)

2) Establish financial support to back up the laws of safeguard.

A. Emery

3) Establish a granting agency, or expand the mandate of an existing agency, with money, to support the development of taxonomy and systematics research as carried out in a museum context; including support for monographic studies and other speciality publications and a section of this agency to specifically support collections.

4) Establish a section within the NSERC mandate to support the training of scientists in the sciences of systematics and taxonomy. This should be done without compromising the principle of good science.

Principle:

Canada considers that the understanding of the fundamental nature of our world is important and commits itself to furthering the study leading to that understanding and to safeguarding the collections that both represent existing knowledge and certain new knowledge yet to be extracted.

REGIONAL MUSEUM-BASED SCIENCE: SURVIVAL IN A MARGINAL ENVIRONMENT

Donald F. McAlpine

It is natural that we should think of our national museum system when we contemplate the goals of excellence in museum-based research and the curation of collections. Nonetheless, across Canada there are hundreds of scientific collections of varying size housed in provincial museums, university departments, and at research stations. Some of these collections rival those of the National Museum of Natural Sciences (NMC) (*since July 1990 known as the Canadian Museum of Nature, following passage of the new federal Museums Act)* in size, scope, and importance.

These so-called regional collections, although they may operate with distinctly regional mandates, may be no more regional than are universities in the prairies, British Columbia or the Atlantic provinces. "Regional" might suggest that these collections are exclusively provincial in content, but this is far from being the case. The kind of fundamental scientific questions that museum curators contemplate the world over can rarely be confined by political boundaries, and this is frequently reflected in the holdings of these institutions.

Although there seems to be more of an onus on regional collections than on national collections to justify their existence, I believe that any attempt at developing a national policy on museum-based research must address the role of regional collections in the national context. The history of many of this country's provincial museums, for example, demonstrates that these institutions have played a pivotal role in contributing to our knowledge of Canadian biodiversity.

Here I wish to comment briefly on the role that regional museum collections and their associated scientific staff can play in Canadian science. In addition I will try to provide some insight into the difficulties that researchers working from Canadian museums with a regional mandate find themselves struggling to overcome.

I should perhaps say that when I use the word "research" here I mean to describe "basic research", the primary goal of which is the production and publication of new knowledge. We can distinguish this kind of research from "applied research" or "summative research" (Nevling 1984). It is the latter type of research that is most important in the production of museum exhibits and

educational programs, whereas in basic research the production of exhibitions and public programs is a possible, but not a necessary, outcome.

At present, I oversee the Natural Sciences Division in the provincial museum in New Brunswick. The Division has a staff of three curators, including myself. We have a single technician position which has been vacant for the past year and a half due to budgetary problems *(filled as of September 1987)*. The three of us curate geological, botanical, and zoological collections that contain approximately 100,000 specimens *(1992 estimates place the NBM holdings in excess of 250,000 specimens)*. Each of us also has individual research interests that are largely collections based. Our mandate, according to the New Brunswick Museum Act, is to "foster and promote the study and public enjoyment and appreciation of the natural, human, and cultural heritage of New Brunswick and of other jurisdictions by collecting, purchasing, preserving and interpreting property which relates to this cultural heritage".

One might argue, why scatter scientific collections all over the country? And indeed, they are scattered. For example, nearly 40% of Canadian insect specimens are contained in more than 100 collections other than the Canadian National Collection in Ottawa (Biological Survey Project 1978). Certainly the concentration of comprehensive collections in a few central institutions should provide a core of researchers with the necessary materials and technical support to pursue large scale biogeographic and systematic studies. But the reality is that in a country as large as Canada the only way that the flora and fauna will ever become known in any detail is through the promotion of regional collections.

Any suggestion that national and regional collections operate at cross-purposes is of course false. At the very least, the promotion of a single adequately staffed and funded regional collection in each province and territory should lead to an increase in the sum national commitment to collections in terms of funds for both collections maintenance and collections-based research.

In the past two decades a number of papers have been published exploring the continuing value of natural history collections to the natural sciences generally. Recently the British Columbia Provincial Museum *(since October 1987 the Royal British Columbia Museum)* issued an entire volume devoted to the subject (Miller 1985). However, with the exception of Downes (1977) and Danks (1983), both of the Biological Survey of Canada (Terrestrial

Arthropods), few authors appear to have recognized the unique and valuable contributions that are specific to regional collections in this country. Drawing on data gleaned from a national survey of insect collections these authors have pointed out the need for strong regional collections supporting faunistic studies, in addition to a strong national collection. What I have to say here reiterates, and I hope complements, the comments of Downes (1977) and Danks (1983).

Regional collections may play a leading role in stimulating local interest in the geology, flora, and fauna of an area. Such collections serve as a point of reference for researchers at local universities and among provincial government departments. They may also support regional needs for identification and the storage of voucher specimens. In a country as large as Canada many workers may find it prohibitively expensive to travel to more comprehensive collections that are situated in a few large centres. The now commonplace computerization of collections data, increasing computer links between institutions, and the normal policy of loaning specimens to established researchers, mean that site visits to collections are rarely necessary. On the other hand, centralizing the country's collections at a few sites leaves them much more susceptible to large-scale damage or loss through natural or man-made disasters.

Equally important for the museum-based researcher is the value of being resident in the region under study. Such presence makes it possible for curators to collect materials and carry out field programs year round. At the New Brunswick Museum we have found that as curators-on-site we have developed a network of personal contacts in the province who regularly provide material for the collections. This has allowed us to amass long, comprehensive, series for some species in a relatively short period of time. Most of this material would not otherwise have found its way into any collection. As any field-biologist knows some of the most valuable acquisitions to any research collection are made opportunistically. Curators attached to regional collections are of course situated to take advantage of such opportunities.

The practical need for knowledge of the biotic resources of this country grows more pressing each year. Environmental impact surveys, now routine, have made many of us acutely aware of the need for regional taxonomic guides and biological inventories. With adequate support regional collections can be ideally suited to serve as the basis and the focal point for such

undertakings.

As well as serving as a source of original scientific information on the biota of a region, regional collections and their staff are available to handle public enquiries, take part in museum sponsored public education programs, and to supply materials useful for public exhibition.

Recent studies by the Canadian Wildlife Services suggest that 84% of the Canadian public take part in wildlife related recreational activities each year (Filion et al. 1983). A growing segment of this population has developed an interest in non-consumptive wildlife related activities such as birdwatching, nature photography, and amateur naturalist activities. The result has been a demand for information on regional floras and faunas, as well as increasing pressure on species and habitats. The role that regional museums can play in promoting regional sensitivity to environmental problems generally should not be underestimated.

The preceding argues that regional museums and their scientific staff have an increasingly important mandate. That mandate, to develop and preserve collections and to carry out collections based research, is the mandate of all museums, whether regional, national, or international in scope.

Curators attached to regional collections must balance the often competing demands of curation, research, and public service. This high-wire act becomes all the more challenging as budgets shrink and positions for technical support staff are left vacant, if they even existed in the first place. Nonetheless, in-house research activities should go hand-in-hand with the maintenance of any active research collection. Therefore it is important that those curating regional collections be expected to develop research programs leading to peer-reviewed publication. Those staff of regional collections who do not follow this course soon find themselves outside the mainstream of scientific activity and the institutions themselves eventually become marginalized in the scientific community. In the long term, collections maintenance and development suffer and certainly science and the science museums in these regions will be poorly served.

There is no doubt that curating any reasonably large collection of specimens, combined with carrying out research on the collection, is best performed by an individual with advanced scientific training. Curators in regional science museums with extensive holdings should be, and are

increasingly, as well qualified as their counterparts in the National Museum or any university. And yet it may be difficult to entice any trained scientist to make a career commitment to a regional museum if a lack of funds precludes pursuing research interests there. Regional museums must frequently struggle to ensure that the expensive business of collections maintenance is possible. The important, and equally if not more expensive, business of mounting exhibitions is the most visible part of the public profile of any museum. At the end of the day, institutional research funds may be virtually non-existent.

The ineligibility of museum-based researchers to apply directly to the Natural Sciences and Engineering Research Council (NSERC) for research funds to support their research programs is disheartening. Cross appointments at local universities have allowed curators in some provincial museums to make application and secure such funds, but such cross appointments are not always possible, or even desirable. In any event, NSEREC funds for those in adjunct positions are normally awarded for the support of graduate students, rather than research programs per se. The system now in place implies that museum-based scientists are for some reason less worthy of having their research activities supported than their university counterparts. This is particularly perplexing when one considers that systematic studies, traditionally carried out in museums, underlie all biological research, and do receive support when they are based in universities. As a global concern over loss of biodiversity has emerged the need for such studies has also taken on a new urgency.

NSERC must recognize this, and should designate a portion of its budget to support systematic studies. Certainly museum-based scientists should have the opportunity to compete directly in the peer-reviewed NSERC granting process on an equal footing with their university counterparts.

The Canadian Museums Association (CMA), the organized voice for museums across Canada, has had little to say about the sorry prospects for science collections and museum-based research in Canada. Part of the blame for this must rest with those of us who curate scientific collections. Few scientists are active in the CMA. Generally, those of us who are responsible for curating collections and who use collections in our research have done a poor job communicating the importance of the collections resource to our colleagues, to the public, and to politicians (McAlpine 1986). It is perhaps time that groups with a concern for the future of science collections and museum-based research in Canada, groups like the Biological Survey of

Canada (Terrestrial Arthropods), the Canadian Society of Zoologists, and the Geological Association of Canada, join forces with the CMA, which has a wealth of experience in the political lobbying field.

Curators of regional collections are often individually responsible for curating a large number of distantly related taxa. It would be unusual if a curator in such circumstances found his individual technical expertise enabled him to cope with all of the plethora of preservation and conservation problems he might encounter. Certainly curators of regional collections should be able to look to NMC staff for help in solving certain specialized curatorial problems related to natural history collections. Indeed, in my own experience we have been able to do this in the past. However, recent NMC staff cuts and funding problems suggest that in the future the expertise we have drawn on may simply not exist in our federal museums system.

This last point brings me to the relationship between regional collections and the national museums system. It may appear paradoxical, but I believe the solution to many of the problems that face regional collections can only be approached through the development of a strong national collection. There is a need for a national perspective if we are to overcome the difficulties that confront regional museum-based researchers and regional collections in this country. Regional collections must be accepted for what they are: a part of the national heritage.

There is a need for the establishment of a formal network of regional natural history collections to be co-ordinated by the NMC *(now easily possible since the new federal Museums Act of 1990 has provision for the creation of Affiliate Museums and "contemporary museological thinking favours greater decentralization of collections", see Canadian Museum Policy 1990)*. I believe all such regionally designated collections should be housed in museums, institutions that by their very definition have a mandate for the long-term preservation of collections. In addition, museums are not biased towards developing collections of economically significant species to the exclusion of other taxa. The latter may actually be more important ecologically and may be those species most useful in answering fundamental systematic, biogeographic, evolutionary or environmental questions.

Such regionally designated collections would become part of the national collection system. Formation of such a network could focus attention on the role of collections generally and the need to ensure adequate support

to maintain this part of our heritage. This suggestion for a network of regional collections linked together through the NMC system is an extension of an idea presented by Danks (1983), which he proposed as the most practical means of carrying out a large-scale biological survey of Canadian arthropods (see Wiggins et al. 1991 for a recent and articulate plea for this approach).

I would envisage such a system as providing potentially much more than the framework from which a survey of the Canadian flora and fauna could proceed. For example, research funds intended to support museum-based research and collections maintenance could be administered through such a system in much the same way that NSERC now handles monies that support the advanced training and research activities of university scientists. It seems to me that much of the physical and administrative machinery for such a system is already in place. There are curators and collections in most Canadian provinces; an Associate Museums program has been in operation for some time and provides a formal network of links between the NMC and certain regional museums *(by 1993 the Associate Museums Program will be discontinued)*. The Museums Assistance Program (MAP), operated by the NMC, *(now handled through Communications Canada)* has administered grant monies that are provided to museums across the country to assist in collections conservation and public exhibits. Science curators in Canada could take much greater advantage of MAP funds to ensure collections maintenance and accessibility than they have to date. Ensuring that the most significant Canadian regional collections and their associated data are readily accessible should encourage museum-based research. The MAP program could do much more to encourage such applications.

The likely dismantling of the NMC Corporation in the near future and the formation of an autonomous National Museum of Natural Sciences *(a reality as of July 1990)*, along with the possibility of increased funds for MAP *(direct funding under MAP will increase from the 1989-90 level of $8.5 million to $18 million by 1994-95, Communications Canada 1990)*, suggest that now may be an opportune time to pursue the idea of establishing a formal network of regional museum-based science collections operating under an NMC umbrella. Certainly, this proposal offers a mechanism by which the NMC could assume a truly national role in the sciences in Canada. It also appears to be an avenue through which museum-based research in this country could be consistently supported, replacing a haphazard and largely inadequate system that has prevented regional collections and regional museum-based scientists from reaching anything near their potential.

In summary, I would suggest that museum-based scientific research in this country could be vastly improved in the following ways:

1. Museum scientists should be provided with direct access to NSERC funds for the support of museum-based research in the same peer-review process as their university counterparts;

2. NSERC should establish a separate budget to support systematic studies at both museums and universities;

3. A formal network of regional natural science collections centres, with co-ordination through the NMC, should be established;

4. MAP and the CMA should make visible efforts to address concerns as they relate to science collections in Canada.

Acknowledgements

I am extremely grateful to Dr. Michael Burt for the invitation to present my views in this forum. My friends and colleagues, Stephen Clayden and Randy Miller, who share my concern and passion for natural history collections, improved a draft of the manuscript with their insightful comments.

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SESSION III

NATURAL HISTORY COLLECTIONS IN MUSEUMS

(Chairman: M.D.B. Burt)

Speakers:

E.J. Crossman: "Natural history collections and museum science: image, mandate, and funding."

G.R. South: "Canadian herbaria."

G.G.E. Scudder: "Natural history collections in Canadian museums."

NATURAL HISTORY COLLECTIONS AND MUSEUM SCIENCE: IMAGE, MANDATE, AND FUNDING

E.J. Crossman

The image of a museum held by the public or by scholars outside museums effects the value placed on both collections and museum science. The dictionary defines a museum as a place for preserving and exhibiting works of nature, art, etc., or any place where curiosities, freaks, monstrosities are exhibited. There is no conation of science in the image most people have of a museum. Possibly this should be recognized in the name of those museums which carry out and disseminate museum science. Possibly the organization in which I work should be named the Royal Ontario Museum and Research Institute.

Even scholars have limited and opposing images of museums. On one hand it is said that there are a million plus insect species as yet unnamed, on the other, that we have learned all we are going to learn from museum collections of birds.

The President of the Canadian Society of Zoologists (Downer 1987) wrote concerning selling biology. He contrasted the worlds of sport and entertainment with their elaborate promotional infrastructure with the small number of science writers who have to milk information from reluctant scientists. Museum science at the ROM probably gets its fair share of the professional PR services available but the lasting effect is no more dramatic than that for Canadian biology as a whole.

The persistent image of a museum as a place of never-changing, dusty displays is probably responsible for the fact that scientists are rarely members of the boards of trustees of those museums which carry out museum science. It is unlikely that the Science Council of Canada had on its board a museum research scientist who is not a member of a University faculty. The nature of museum science is sufficiently different in the triple aspects of curation, research, and transfer of information to warrant such representation. Museum science in one institution can include as many as 10 disciplines, or subdisciplines, within Botany, Zoology, Palaeontology, Geology, and Mineralogy.

The lack of awareness of governments is often made obvious by the fact that research museums that have displays are placed in ministries designated Culture and Recreation or Citizenship and Culture. Museums are cultural

agencies and the number of government departments is limited. However, the word culture has a narrow meaning in the mind of the public, and that definition does not include science. I'm not certain that ROM, once touted as the largest University museum in the commonwealth, fared any better when it was part of the Department of Education or the Ministry of Universities and Colleges.

The staff of the ROM has regularly attempted to provide new members of the board of trustees, and through them the government, with an insight into the scope and functions of the unusual and complex organization with which the trustees have affiliated themselves. In the latest of these they were told that if the essence of the museum was its collections, and the manifestation of it was its displays and lectures, then the guiding force was its research and publications. A great museum is one in which the interplay of all these elements and their support, both philosophical and financial, are in balance.

Possibly the museum image is improving. The specimens in the collections and their associated data, along with works of art and furniture, are now designated a Cultural Heritage. A collection without an appropriate staff will, however, not only deteriorate but will never be "converted" to useful information, or be available for use by scholars in distant places. The national heritage is actually 1) an organized collection with data, 2) the trained and committed people that work with the specimens and the class of objects represented by the collections, and 3) the assembled literature. Working "with the collection" often involves working with and interpreting not only the objects in the collection but the class of objects represented by the collection. The latter often involves the study of living plants, animals, etc. in situ, and at large. Too often the literature and support provided by in-house libraries is neglected. Literature is required for collection management, research, teaching, displays, and the provision of instant information to the public. In addition to purchased items the literature consists of publications derived from interpreting the collection and those of museum workers elsewhere obtained in exchange.

An image can be enhanced even by the provision of statistics. I'm certain that even most university faculty members would not be able to name the natural history research collections in Canada. It would be useful to broadcast how many there are, and to grade them by size and richness of collections, permanence, staff, breadth of involvement, and productivity. The survey of "Orphan Collections" being carried out by the Canadian Society of Zoologists

is a good example of this kind of information on Canadian collections. The ready availability of this type of information would not only publicize the existence, cultural value, and activity, of Natural History Collections but also assist with decisions on funding and staffing. More general knowledge of the collections, their locations, and special interests, would encourage others to deposit valuable specimens. Such surveys have been carried out in the U.S. under titles such as National Plan for Ichthyology (Lachner et al., 1976), or Ornithology (King and Bock 1978), etc. In addition to the U.S. national plan for Ichthyology, there was a list of Fish collections in the U.S. and Canada (Collette and Lachner 1976). This may have been the first general discussion of the status of Canadian collections. Only four Canadian collections were listed but ROM and NMNS (now CMN) were judged 11th and 12th of 155 tabulated. The only other survey of Canadian ichthyological collections, to my knowledge, was that prepared for judgement on eligibility for the National Heritage Inventory, and it was never published. A beginning in regard to more general publications dealing with collections and their role in research has been made (see Miller 1985) and the activity should be expanded.

In contrast to artifacts of Human History, Natural History specimens do not usually have a market and as a consequence have no market value. As a results it is difficult to make such straight-forward decisions as insurance evaluation, and as Howie (1986) said to raise public and political sympathy for them.

A major image problem (or benefit?) is the fact that at any one time we are unaware of uses to which specimens in research or reference collections will be put in the future. In the 1930's the first curators probably had three basic concepts of purpose - taxonomy, systematics and biogeography. They would never have imagined uses such as analysis for toxic substances before and after a specific industrial development. In the very apt comparison of the collections to libraries, it is true that the future uses of the stored knowledge are impossible to forecast.

The policy and mandate of a museum committed to the composite of curation, research, and display should provide for two major factors 1) recognition of the fact that research is individually oriented and motivated, 2) that there should be a balance of duties and time commitments which provide for as a balance for in the various activities. Policy statements are necessary to provide governments with confidence in regard to role, objectives and accountability. Mandate should be adequately, but not restrictively defined. There is still considerable need for the traditional museum pursuits of

taxonomy, nomenclature, systematics and biogeography. Wiggins (1986) spoke of the importance of systematic studies of local insects in the understanding of the global affinities of genera within families. He also emphasized the impossibility of working at depth in the ecology or management of terrestrial or freshwater systems without confronting problems arising from deficiencies in basic systematic knowledge. Much of the excitement in museum science today is in the application to the so-called traditional practices, of new techniques for deriving and interpreting results, particularly genetic information.

However, mandate should not be so restrictive as to limit museum science to the specimens in the collection. Studies allied to the subject area of the collections yield information derived from living plants and animals which has direct application to societal problems. A study of the biology of a local reptile provides new knowledge which can be applied by others in a number of ways including assignment of an appropriate status within the Council on the Status of Endangered Wildlife in Canada (COSEWIC). These associated studies often have greater obvious public impact than do more traditional museum studies and by reflection help promote the value of the traditional studies in the same institution.

Over the years the emphasis in museum programmes shifts to reflect governmental attitudes, or the history of the institution. These shifts usually call for changes in priorities. In those cases the least obvious, least understood, and most individually-oriented activity - research - is usually the first to suffer.

An obvious mandate arising out of traditional museum functions and the known gaps in our systematic knowledge is a Biological Survey of Canada. Although there has been historical federal emphasis on a geological survey, serious national interest in a biological survey has evolved only recently. The laudable initiative and example of the Canadian Society of Entomologists is proof of the benefit which can accrue when a national activity is organized by scientists in a special interest group. It is difficult, however, to perceive what interaction between 1) federal and provincial governments, 2) scientists in scientific societies and 3) natural history collections, will be most effective in accomplishing a general survey. There is a considerable difference between disciplines in the amount of information available so it is also difficult to know how to encourage all groups of scientists to participate.

Recent changes in biological activity associated with new responsibilities

(e.g. environmental impact), and with new techniques (e.g. electrophoresis, DNA-RNA) have created new mandates for natural history collections (e.g. voucher specimens, community collections, and long term storage of frozen tissues at extreme cold temperatures). All of these call for reorganization of space and collection management techniques or new equipment.

Canada has considerable involvement with third-world nations particularly through organizations such as CIDA and IDRC. There is a rush in these nations towards greater self-sufficiency in food production, and a better standard of living. There is also a resulting drastic change in environments, both terrestrial and aquatic, and the floras and faunas associated with them. The protection of biodiversity, particularly in tropical rainforests has become of paramount concern. Collections and museum science have a prominent part to play in this concern.

Museum science in general can benefit from salvage collecting in these forests and nations prior to further destruction. CIDA and IDRC often consider faunistic work less important than developmental projects and consider "taxonomy" as something esoteric which, if needed, can be done later. The proper concept of codification of floras and faunas along with management of floras and faunas, and the benefit of museum, or faunistic and floristic, studies as part of the mandate of CIDA or IDRC would increase the benefit of the assistance Canada provides those nations.

I have heard it lamented, in the past, that the National Museum of Natural Sciences supposedly had no formal mandate to undertake or support research. In contrast ROM has a strong written research mandate but, at present virtually no financial structure to support research in natural history beyond salaries, laboratories, some equipment, some expedition support and supplies. As in universities, research at ROM is almost totally supported by federal grants and, more recently, one provincial granting agency. The usual, and virtually only, source of federal grants for museum research in Canada is NSERC. However, museum scientists do not have direct access to NSERC and can apply only if they have a faculty appointment at a university. To be eligible a museum scientist must add to his/her museum duties an additional 20 to 30% of time spent on university duties. I am fully aware that university involvement of museum scientists has benefits to the scientist, to the museum, and to museum science. It is however unfortunate but true that the amount of museum research that can be completed is often reduced by the additional duties, other than research, which must be taken on. In addition some museum scientists have suggested that the need to compete in a grant scheme

established primarily for work other than museum science forces the museum scientist to revise his/her research. The weight placed on number of completed publications in grant decisions makes long-term revision work difficult, so shorter less-significant projects are developed in order to compete. In addition large revisions are best published in single larger works. These are not accepted by most of the journals given the greatest weighting in peer judgements of research publication associated with grant applications.

Another effect of NSERC as the major, or sole, source of funding is the need in the past for museum research to fit into a grant structure (e.g. codes, committees, etc.) which was not actually constructed with that type of research in mind. The president of the Canadian Society of Zoologists wrote recently that scientists are being expected to do more and more with fewer dollars. This has long seemed to have been true for museum science. NSERC grants for museum science have, on the average, been lower than those for research by "university scientists" with comparable credentials. In contrast to this, recent information made available by the Dept. Zoology, University of Toronto (Anon 1986) suggests value per dollar was higher for museum science. The figures indicated an average cost at the Dept. Zoology of 6187 NSERC dollars per refereed publication as compared to a cost of ROM of 2420 NSERC dollars per refereed publication. Yet the average NSERC grant to cross-appointed ROM staff was approximately $12,000, and approximately $33,000 to their University of Toronto colleagues.

A third problem of funding is the unique association in museum science of the research and the research or reference collection. Museum science is quite different from university research in this regard. The specimens in a research or reference collection have intrinsic and future values beyond the contribution they make to any particular research. This is even truer today as a result of the development of the opportunity to utilize collection specimens in DNA analyses. They remain available for other work. In this way they are distinct from specimens used in laboratory research which are usually consumed by the needs of a single project. Costs of care and maintenance of specimens involved in a laboratory experiment are legitimate expenses on a research grant. Federal funding is made available for museum research, federal funding has recently been made available for electronic data processing of museum catalogue data, but no federal funding is available to support care, curation, and storage supplies for those more permanent specimens, used internationally, and now considered national heritage items.

The US counterpart of NSERC, NSF, has within it the Biological Research

Resources Program of the Division of Biotic Systems and Resources. That program has recently provided $10M annually. The bulk of this (60%) is awarded to museums for collection support including buildings, equipment, and start up salaries for support staff.

As a consequence of a number of these funding problems it is growing more difficult to find funds for collecting as a precursor to research and as a means of enriching research collections. It is unfortunate that this occurs just when museums should be more involved in salvage collecting in tropical environments which are changing or disappearing so quickly.

One of the surprises of museum science in natural history is the total absence of involvement in studies of museum conservation. The ROM, unified for almost 30 years has a Conservation Department with origins in a previously separate Museum of Art and Archaeology. That department has specialists in several areas of art and archaeology artifacts. To my knowledge no work is done there, or in any other Canadian museum, on ways of restoring natural history specimens, or of preserving them with less troublesome chemicals, or of assuring an extended opportunity to use the specimens for their intended purposes. Conservation work of this nature might assist with recent increased controls on toxic and dangerous substances which have led to problems shipping formalin on field trips, and shipping loans of research specimens in ethanol.

Publications in museum science may be a serious Catch-22 unless ROM's experience is unique and not typical. Scientists advance personally by productivity, grants to continue research depend on producing published results, annual operating budgets are protected or increased by concrete results and completion of projects listed as underway in previous budgets. However museum publication budgets (funds and personnel) never seem to keep pace with this research expansion and the expansion in demands for publications associated with public programmes of the museum.

NSERC at one time would not allow ROM Life Sciences publications to be listed in grant applications. More recently they have allowed them to be listed, but they are weighted lower than publications in some US journals in spite of the fact that the ROM scholarly publication policy, and refereeing, are as stringent as those for the U.S. journals, and our circulation as great as that of many of them. As a result, museum scientists are compelled to publish elsewhere in order to compete. Then submission to the scholarly series at the museum go down to the point where virtually only Research Associates are

publishing in the series. At this point the Life Sciences Editorial Board finds it difficult to request that adequate funds be earmarked for this purpose in future budgets and funds cannot be carried over from one year to the next. The final consequence of this is a sudden rush of productivity of smaller papers or the appearance of one or two very large monographs in a year when there are fewer funds available. This of course starts the vicious circle over again.

Decrease in production of ROM publication reduces the rate at which the ROM Library can exchange publications with more productive U.S. museums. This exchange reduces the cost of acquiring the works of other scientists for our library. When our exchange becomes severely limited other museums cut off or threaten to cut off their mailings to us. Eventually this would require an increase in library budget or the cancellation of some journals to purchase what was previously obtained by exchange.

The alternative taken to compete for grants often involves page charges. There is no access to central publishing funds for this. Much of the specialty literature of greatest use in departments is derived by exchange of reprints. Other than in a limited number of cases where they can be built into a grant, costs of page charges and reprints of outside publications must be derived from the Supplies category of departmental budgets - the most overworked segment of those budgets.

As usual the image problem got in the way recently when the Canadian Association of University Teachers forgot the unique mandate of museum research when they requested the federal government to commit itself to taking prime responsibility for funding university research. No representation was made for museum research.

As a means of initiating serious discussion of the needs of natural history collections and museum science, it is recommended that -

1. Organizations which represent science to federal and provincial governments increase their efforts to promote the value of the faunistic activities of Canadian natural history museums whether federal, provincial or university. The present and future endangerment of local, regional, national and international faunas makes obvious the need for intensification of museum science.

2. The museums themselves make a concerted effort to 1) adequately promote the role of museum science, 2) accept the responsibility for the transfer and interpretation of science for the public, 3) set adequate funds aside from operating budgets for these responsibilities, and 4) continue to adopt a responsible attitude toward selection of material to be curated, and make material surplus to their own needs available to other museums in Canada and abroad.

3. The appropriate scientific societies encourage Canadian natural history museums, and the scientists associated with them to become involved, individually or via the participation of their special interest scientific societies, in the promotion of museum collections. The museums and scientists should be encouraged to prepare "National Plans" detailing present condition and strength, present weaknesses, forecasts of appropriate future directions and needs. Funds should be made available to assure such analyses are suitably published and distributed.

4. The federal government should undertake to determine the potential benefit to museum science in Canada of the establishment of a national organization similar to the Association of Systematic Collections in the U.S.

5. There be a member on federal science policy bodies to represent museum science. That member should be drawn from an active museum outside a university but that member should speak for the unique character of museum science in or out of universities.

6. Federal-Provincial study groups promote the idea that where regional mandates exist in museums, that these be relaxed under appropriate circumstances. If a museum (or its scientists) is able to develop an opportunity to apply museum science to a flora or fauna outside that mandate, and can demonstrate expertise that will both advance the understanding of natural history and benefit both Canada and the other area, that museum should be encouraged to participate.

7. Natural History Directors recommend to the federal government the continued and long-term funding of at least two features of the past National Museums Corporation. These are the Cultural Heritage Inventory Network and the newer National Data Base.

8. Museum Directors promote the value of the Biological Survey of

Canada. That the federal government undertake to stimulate individual Canadian scientists, and organizations of scientists interested in various segments of the fauna and flora of Canada, to follow the laudable example of Entomologists by organizing and pursuing work similar to that being done with Canadian Arthropods. That MOSST attempt to see that funds become available when such initiative indicates that appropriate work will be done.

9. External Affairs suggest to Canadian Agencies such as CIDA and IDRC that faunistic work is basic to the requests of third world nations for Canadian assistance in the task of increasing their self-sufficiency in regard to food production. The exploitable faunas and floras of those nations need to be understood if they are to be sensibly managed.

10. Canadian professional societies associated with various objects traditionally housed in natural history museums become active in an attempt to persuade federal and provincial departments of the need for better support for the collections and research activities of those museums.

11. MOSST strive to attain for museum scientists in Natural History the direct access to federal research funding (NSERC) enjoyed in the past by museum scientists in Human History (SSHRC).

12. MOSST petition NSERC to give continuing concern to the mandate, and structure of grant application and judgement in relation to indirect or direct access for museum science. The nature of codes, etc., and the composition of committees to which applications are forwarded for consideration, should better reflect the differences between "museum research" and most other "University research".

13. There be established within the federal government of an agency that would support the breadth of the collection responsibilities (in contrast to research) of Canadian natural history museums. Although it would be mostly a funding organization its existence would also enhance the recognition and promotion of the regional, national and international value of natural history collections in Canadian museums.

14. The federal government attempt to alleviate museum budget problems in a small way by negotiating exemptions to federal sales tax, excises and duties and other government taxes. Exemption should be

considered whenever purchases etc. can be demonstrated to be articles or services critically required for collection management or research and not available in Canada. Attempts should be made to circumvent present denials based on the concept that articles are "of the nature of goods made in Canada".

15. Natural History Museums in Canada communicate better and more meaningfully with the federal government and with one another.

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CANADIAN HERBARIA

G. Robin South

(More than 5 years elapsed since this paper was prepared. The author regrets that it was not possible to update statistics: The remarks should therefore be considered in light of this.)

Summary

Herbaria are the basic materials for much of botanical research and teaching and the collections form the foundation for botanical nomenclature and taxonomy. They are also an important historical archive and preserve Canada's botanical heritage.

Canada's herbaria date back to 1839 with the establishment of the herbarium at the University of New Brunswick in Fredericton. Four hundred and four collections have been catalogued, of which 335 are institutional and 69 private. Of this total some 248 are still 'active', while the remaining 156 have been consolidated into other collections or lost. Canada has no major herbaria in the international sense (a major collection would house more than a million specimens). The National Herbarium (830,000 specimens), and the Biosystematics Research Institute, Department of Agriculture (900,000 specimens) serve as Canada's national repositories and are widely regarded as well curated and a good national resource. Canada's total plant collections (vascular plants and cryptogams combined) are less than 5 million.

National and regional herbaria are essential and complimentary elements of Canada's herbarium system. Regional herbaria (university collections, provincial museums, Federal laboratories, etc.) have unpredictable funding and many are short-staffed. University collections, which in many cases serve as the principal resource in a region, are in the most serious jeopardy.

It is recommended that:

- A national policy on the preservation and funding of Canada's herbaria should be developed.

- A catalogue of type collections in Canadian herbaria should be prepared.

- An urgently needed national policy on systematic publications must be developed.

G. Robin South

I. Canadian Herbaria - definitions, functions and classification:

Ogilvie (1985) and Radford et al. (1974) are among many who have attempted to define what is meant by an herbarium. I quote them directly here:

> 'Museum collections of plants are the basic materials for much of botany. They are the ultimate reference for the identification of unknown plants, they are the foundation for botanical nomenclature and taxonomy, they are the bases of all floras and taxonomy, they are the bases of all floras and taxonomic monographs, they are a historical archive for diverse botanical studies, and they are a source of materials for education and public information.' (Ogilvie, 1985: 13).

> '...the herbarium is a collection of dried plants for educational and research purposes, and a special kind of museum, a reference source and a data bank, for past, present, and future studies in botany.' (rephrased from Radford et al., 1974: 751).

It follows from the above that herbaria are the repository of a region's or nation's plant resources, and a more or less permanent record of those resources for the use of laymen and scientists alike. The preservation of this heritage, its security, and its availability are the subject of this presentation.

The functions of an herbarium have received a great deal of attention in the literature, and may be divided into a number of discrete areas, as defined by Ogilvie (1985), viz:

- As repositories for type specimens and important historical collections.
- As sources of material for research for taxonomic monographs and floras.
- As sources of baseline data for phytogeographic documentation.
- As a source of loans, exchange specimens and exsiccatae.
- As a reference collection for identification purposes.
- As a repository for voucher specimens.
- As source material and a supply of voucher specimens for ancillary

research.

- As a source of materials for public exhibits.

Herbaria may be classified as major, regional or local. Major herbaria would house more than a million to several million specimens, and would contain many type specimens and historically important collections. Ogilvie (1985) states that there are approximately 18-20 herbaria in this category, world-wide. No Canadian collection falls within this category: the National Herbarium of Canada, for example, houses 500,000 vascular plant specimens (including 200 TYPES), 93,000 lichens, 215,000 mosses and liverworts, and 22,000 algae: a total of more than 830,000 specimens. The Herbier Marie-Victorin, Institute de Botanique, Université de Montréal contains some 600,000 specimens, while the various sections of Agriculture Canada's Biosystematics Research Centre contain approximately 900,000 specimens. These larger collections, while not strictly major in the international context, do represent Canada's prime systematic resources and are widely recognized by the botanical community as being well curated and adequately housed. Canada's larger herbaria fall into Ogilvie's (1985) category of Regional Herbaria which, by his definition, house less than a million specimens. In Canada herbaria in this category function as national repositories. Worldwide, many national, state, provincial, university or museum herbaria fall into this category. While they may serve national needs, they are also depositories of voucher specimens, and often serve as a basis of regional or national research projects and as the data base for the preparation of national or regional floras. Their coverage may be regional or world-wide, and may be uneven among the various plant groups. The majority of Canadian herbaria fall into Ogilvie's category of local herbaria. These may house relatively small numbers of specimens and may comprise reference and teaching collections. Many university herbaria are of this type, and most private or personal collections would be classified here.

II. The Canadian herbarium resource:

There have been a number of surveys of Canadian herbaria (e.g. Woodland, 1979), the most comprehensive being that of Boivin (1980). While some of Boivin's (1980) data are out of date or incomplete, they provide a detailed reference and historical account of herbaria in Canada.

Historically, the oldest herbarium in Canada is that at the University of New Brunswick, Fredericton, founded in 1839. The Nova Scotia Museum (1850) is the next oldest, with the National Herbarium (1882) and the

Department of Agriculture (1886) starting much later (Boivin, 1980).

Boivin (1980) listed 404 herbaria in his survey. Of these 335 were given as institutional, and 69 as private, 218 of the institutional collections were regarded as still active (i.e independent, with some curatorial activity and not merged with another collection), while 117 were inactive or merged with larger collections. Thirty of the 69 private collections were still in private hands, while the remaining 39 were lost or turned over to an institutional collection. In summary, 248 of the total collections were still active, and 156 were consolidated, inactive, or lost.

Statistics generated by Boivin (1980) give an indication of the national resource. Less than five million plant specimens are housed in Canadian herbaria (including flowering plants and cryptogams): this national total constitutes less than the total specimens housed in a single collection such as that in the New York Botanical Garden Herbarium and the Department of Agriculture):

Atlantic - 11 herbaria, total collections	269,000
Quebec & Ontario - 25 herbaria, total	2,023,000
Prairies & the West 16 herbaria, total	976,000
TOTAL	3,268,000

III. Survey of Canadian herbaria:

In order to assist me in addressing some of the issues pertinent to this workshop, I conducted a survey of 74 herbaria listed in the Index Herbariorum (Lanjouw et al. 1974). Twenty-six responded in some detail to the six questions that were asked, and I deal with these in turn here.

1. - Does Canada have an adequate system of herbaria?

The answer to this question is unreservedly positive, with the qualification that there is no 'system' as such, and there is a lack of any national policy or funding strategy. While the 'system' may be adequate, there are some short-comings which need to be addressed. As far as vascular plants are concerned, two national herbaria (as identified under I (above)) adequately serve national needs and provide a reliable reference system to all Canadians. The geographical coverage of their holdings is not, however, comprehensive; it is the role of regional herbaria to fill in the gaps. As indicated earlier, even the largest national collections of vascular plants

(CAN: MT, DAO) are not on a par with major collections such as those in Kew, New York or Missouri. As has been pointed out by Luc Brouillet, however, the situation is very different when the cryptogamic groups are examined. CAN and DAO assume the larger responsibility for preserving representatives of the Canadian cryptogamic flora, but when the regional institutions are examined a very patchy system is evident. Brypophytes are well covered in western Canada and the Maritimes, but poorly in central Canada. The situation is much worse for lichens and algae; there is no major or comprehensive collection of algae housed in a national institution.

The lack of a national or regional policy on herbaria means that communications are less adequate than they might be, and that there is no consistent or reliable provision for information exchange between widely scattered institutions. Herbarium practice has led to a number of standard procedures and practices, but again there is no prescribed standard against which all collections should be curated and maintained.

2. Is the custodianship of our national and regional collections adequately provided for at the present time and for the future?

There is widespread evidence that the custodianship of Canada's national and regional collections is not adequately provided for at the present or for the future. Even for those institutions committed to the custodianship of collections, current budgetary constraints are a cause for concern. The National herbarium has been traditionally well funded, both for curatorial and research work; for the 1987-8 fiscal year the Botany Division has received its requested support for collections. There is less certainty, however, about the funding for capital equipment and expansion plans, and there is a dismal picture regarding research funding. Furthermore, the NMC has cut off all funding for museum publications.

The question of the importance of regional versus national collections is addressed under 5 (below). What is very evident, however, is that the role of the regional collections has largely fallen under the purview of the Universities; there are few instances where provincial agencies have the major responsibility for a regional collection. While this situation should be no cause for concern, funding and other problems within the Canadian university system have resulted in a great deal of uncertainty about the long-term custodianship of their important collections. The preservation of Canada's plant heritage is, therefore, facing uncertain times.

A recent survey of New Brunswick herbaria (McAlpine, 1986) provides a useful insight into the state of regional collections. There are eleven

institutes in New Brunswick with herbarium collections, and they contain a total of 40,476 specimens, with a mean collection size of 9,939. Seventy-four percent of the plant collections originate in New Brunswick, 26% from elsewhere. The best representation is of flowering plants, and some taxa (e.g. cryptogams) are very poorly covered. Most seriously, there is a great deal of uncertainty about the long term maintenance of any of the collections, and few have designated curatorial positions. While New Brunswick's investment in herbarium collections is comparatively low, the general picture that McAlpine describes regarding their maintenance and future is probably symptomatic of the regional picture in many parts of Canada.

In summary, there is good reason for concern about the present and future custodianship of Canadian plant collections. The lack of any policy, either by granting agencies or by institutions, regarding the importance of maintaining significant systematic collections could suggest that the collections have no value. Universities thus have no firm commitment to keep these valuable resources. At the very least, every effort should be made to transfer endangered collections to regional or national institutions where they can be properly curated.

3. Is the present policy regarding type specimens adequate to ensure their long-term preservation and deposition?

The preservation and deposition of types appears to be reasonably well in hand, even though there is no actual national 'policy'. Standard practices regarding the special housing of types are enforced in national collections, although it is remarkable to note that the National Herbarium still has no smoke or fire detectors, even though they have been requested for about three years.

There are few large collections of types in Canada, and there is no national register of types: the latter would be a very valuable tool for systematists. A microfiche publication could be prepared, similar to that recently produced for sections of the British Museum (Natural History). Types are widely scattered throughout the regional collections, and there is not enough information available at the present time to indicate whether they are all in safe quarters. Researchers have often taken the precaution of distributing isotypes to other institutions, and it would be a good national policy to require that wherever possible isotypes (or holotypes where inadequate storage facilities exist) be sent to a recognised national collection. It is noteworthy that, in the absence of such a national policy, there has been a tendency in some cases to send Canadaian type material to institutes in the United States, or even Europe.

4. Are Canadian plant collections readily available for research and loan? If not, what are the problems?

For the most part Canadian plant collections are readily available for research and loan. Historically, this was not always so with respect to the National Museum, although this problem no longer exists. Difficulties in obtaining loans are mostly related to staffing problems, with long delays in some institutes where the handling of loans is a task performed by over-worked curators, or volunteers. Some herbaria are, however, purely for reference purposes and must be visited if the specimens are to be seen. Where curatorial staff are unavailable, or where a collection has been placed in storage, loans cannot be arranged: there are presently no available figures on the extent of Canada's collections which might be unavailable on these grounds.

5. What feelings do you have regarding National versus Regional collections?

Strong national and regional collections are essential, and they serve different functions, as pointed out above. National collections should serve as the reference collections for the nation, and should also cover those areas not within the purview of any regional herbaria. However, much more exhaustive collections are needed for regional purposes, and it is in regional collections that these should be housed. Regional collections include those in provincial museums and institutions, as well as in the universities. As a matter of policy, efforts should always be made to deposit representative sets of specimens from regional collections in national collections, where they will be insulated from at least some of the exigencies of funding.

Any suggestion that national and regional collections represent duplication of effort is erroneous; while most endorse the need for a well curated national collection with a good core of qualified researchers, they also recognise the complementary nature of regional collections. Strong regional collections certainly stimulate regional strength in research, and provide the extensive local collections necessary for detailed monographic work. Regional collections also allow for the essential interchange between amateur and local collectors with readily available taxonomists and herbarium resources.

In Canada, unlike in the United States, it would be erroneous to assume that the national collections represent adequate national coverage. There is just no comparison between Canada's national collections and those of the U.S. or Europe. The importance of good regional herbaria is therefore that much greater in Canada. In her response to this question, Marcia J.

Waterbury, Curator of the McGill University Herbarium, made the succinct statement that: 'Regional collections (including university herbaria) are of equal importance, for they can provide more in-depth coverage of specialty areas and provide local centers of botanical expertise for researchers and laymen alike.'

To a considerable extent the responsibility for the maintenance of regional collections has fallen to the Universities, where much of the scientific work associated with the collection has originated. Yet these collections are now endangered by the exigencies of funding and by growing pressure on the departments where most of them are housed to make room for more 'trendy' aspects of biological research. The bulky herbarium is a prime candidate in the all-too-familiar university 'space wars', and has been the victim in a number of instances documented above. There is an urgent need for a national policy to ensure the proper funding of major regional university herbarium collections.

University collections are usually less available to the general public that those in regional museums or similar institutions, and the specimens are often less available for public display purposes.

6. Do you feel that collections in Canadian universities are adequately housed and curated? Are they readily available to others for study? If they are not, what plans would you suggest be put in place to rectify the situation?

As described in 5) (above), the support for University-based collections gives reason for very serious concern. A number of well-known case histories exist, but many are symptomatic of the declining availability of funding from, for example, the Natural Sciences and Engineering Research Council. NSERC cannot supply operating monies for herbaria, so requests for this are declined. When this lack of support is coupled with the growing need of university departments to keep up with trendier (and more expensive) areas of experimental biology, the fate of University collections is obvious. Examples of University collections in trouble include UBC, Lakehead, the University of Toronto (the collections were recently transferred to the Royal Ontario Museum) and the Louis-Marie Herbarium at Laval. The majority of University and smaller regional collections share the same problems; lack of staff, inadequate funding, and an increasing reliance on volunteer help. Apart from these logistical problems, there is a lack of tradition in maintaining collections in Canadian universities compared with, for example, that in Europe. University collections may be at the mercy of unsympathetic administrators, and are under the care of one or a few committed individuals.

There is often no provision for their continued maintenance once the curator has resigned or retired. As a consequence there are instances of collections being transferred elsewhere, being stored in entirely unsatisfactory conditions, or even being jettisoned.

IV. Recommendations:

The following recommendations would seem in order with respect to Canada's herbaria.

1. A national policy on the preservation and funding of Canada's herbaria should be developed.

In the development of this policy, the needs of all collections should be considered jointly. A useful starting model would be the policy proposed by The Association of Systematics Collections in the United States: America's Systematics Collections: A National Plan (Irwin et al., 1973; see also Advisory Committee for Systematic Resources in Botany, 1979).

The policy should be developed with adequate input from federal and provincial agencies, universities, and funding agencies with responsibility for natural history collections.

2. A catalogue of TYPE collections in Canadian herbaria should be prepared.

3. An urgently needed national policy on systematic publications must be developed.

Acknowledgements

I am grateful to the various herbarium curators who responded in detail to my questionnaire, and at such short notice. I also thank Joyce Taylor, Department of Fisheries & Oceans Biological Station, St. Andrews, for her assistance in obtaining necessary references, and Ellen Tracy, who helped in the preparation of the questionnaire.

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NATURAL HISTORY COLLECTIONS IN CANADIAN MUSEUMS

G.G.E. Scudder

My main concern is the future of collections and responsibilities.

In order to outline the problems in this area, I will talk about insect collections in particular. In 1978 there was none in the NMNS; they were all in other places with diverse priorities and problems.

In an assessment of the Canadian arthropod collections, carried out by the Pilot Study for a Biological Survey of Canada in 1978, the Entomological Society of Canada committee documented the existence of 96 collections in Canada, 44 of which had over 10,000 specimens. Our report at that time noted their scientific value, but called attention to the fact that virtually all of them were inadequately maintained. The situation has not improved, and judging by the recent data given by Howie (1986) in the ROM meeting on collections, the situation is not much better elsewhere in the developed world. Few have guarantees for the future.

As an example, let me talk about the UBC collections in zoology.

The first professor and head of zoology at UBC from 1924 to 1940 was C. McLean Fraser, an expert in hydroids. He described many new species and wrote major monographs. Most notable were the ones on the Hydroids of the Pacific Coast of Canada and the United States, published by the University of Toronto Press in 1937, and one on the Hydroids of the Atlantic Coast of North America, published by the same press in 1944.

His valuable systematic collections, including much type material, were left to the department. There they remained unstudied for many years, and deteriorated to such an extent, that much has had to be discarded.

While succeeding heads of the department were interested in systematics, they were not interested in hydroids. Instead, they built up large collections of fishes, birds and mammals. The invertebrate faculty appointed were interested in physiological ecology, and had little appreciation or concern for the drying out hydroids. Since the department and the university had no funds or commitment to Museums or collections, they were neglected.

Although the California Academy of Sciences at one time asked for the Fraser hydroid collection, I gather they were retained as valuable heritage material, but received neither study nor care.

Prior to the time I took over as Head, and largely through the efforts

of Mary Arai, the remnants were rescued and are now in safe keeping.

There are many similar instances that I could document from across the country.

When I took over the headship of zoology, I inherited 3 museums and two minor collections. However, these had no committed curatorial staff and no maintenance budget. Any care was the result of individual faculty members efforts, dedication and research budget siphoning.

Being interested in systematics and realizing the problems, I was able to obtain positions and budgets to provide for 3 professional curators for the vertebrate, fish and insect museums, and a supplies and expenses budget of $13,500.

The collections occupied 6735 square feet of space, contained over 1.2 million specimens and have a replacement value of $7.25 million dollars.

Since 1976, we have had no general increase in Supplies and Expense budgets. Indeed, we have had severe budget cuts and we are now operating on a total budget down 27% from 1978. We have 6 less faculty and only 50% of the operating budget of 10 years ago.

Our main function is teaching and research. This is now maintained at a minimal level. We have managed so far to retain the 3 curators, but the operating budgets for the collection is down $7,500 from $13,500 in 1978.

With continued budget cuts and retrenchments, I wonder how long we will be able to retain our present staff.

The Museums and collections remain because of my own priorities, backed by a number of interested faculty, but I worry a great deal about the future. Should we be doing something about the collections now? What is the best strategy for the future?

When we considered the plight of the Museums in 1978, we identified 4 solutions.

1. Keep minimal "class collections" for teaching and research, and dispose of the rest to some provincial or national repository. If we did this, we would limit the depth of our own teaching and research and abdicate our educational responsibility in systematics. Without collections, we could no longer do research in systematics effectively. While you might argue our

students could travel to Ottawa, Toronto or Washington, D.C., they do have course work, teaching duties and no funds for modern air fares.

2. Status Quo. This is no solution in the long-run.

3. Recognize the value of museums and fund at an adequate level. This is not likely in the foreseeable future with current university funding levels.

4. Develop a Museum network across the country, with a Regional Museum on the campus. Previous Science Council reports suggested this. In 1978, we attempted such a solution. We obtained agreement from the Provincial Museum and approached the National Museum of Natural Sciences. This proposal was backed by the Museums Corporation and went to Treasury Board, but there died.

I support the development of a National network, but I plead that it be developed soon.

SESSION IV

OUR TECHNOLOGICAL HERITAGE: DEFINITION, CUSTODIANSHIP, AND INTERPRETATION

(Chairman: W. McGowan)

Speakers:

Paul Carle: "La recherche sur une collection d'anciens instruments scientifiques: elements d'interpretation."

Paul Donahue: "What's new at the old bun factory?"

Louise Trottier: "Le patrimoine de l'industrie: Un champ d'honneur ou d'oubli?"

LA RECHERCHE SUR UNE COLLECTION D'ANCIENS INSTRUMENTS SCIENTIFIQUES: ELEMENTS D'INTERPRETATION

Paul Carle

Certains d'entre vous connaissent probablement la collection d'instruments scientifiques du Musée du Séminaire de Québec. Avec plus de 1000 instruments, cette collection est reconnue comme l'une des plus importantes du genre en Amérique. J'ai eu l'opportunité, de 1983 à 1986, d'effectuer un inventaire complet de la collection et de faire des recherches en archives sur son histoire. D'une façon générale, on peut en identifier les véritables débuts avec ceux du XIXème siècle. Non seulement les instruments ont-ils été acquis à partir de cette période, mais dès 1806, ils trouvent place dans les vitrines du "Musée des sciences" du Séminaire de Québec et plus tard de l'Université Laval. Donc les phénomènes d'acquisition, de collection, de conservation, d'exposition naissent simultanément.

Il semble donc qu'il faille voir là, la première forme de muséologie québécoise ou Canadienne des sciences et des techniques. Des cabinets ou musées de botanique, de chimie, de zoologie, de géologie et autres viendront s'ajouter tout au long du XIXème siécle, aux cabinets de peinture, d'estampes, de médailles, d'art, d'origines diverses. On a souvent tendance à qualifer ces premiers musées, cette première génération de musées, de musées "vitrine", en impliquant ainsi l'image d'objets inaccessibles, poussierreux, tout à fait statiques dans une organisation tout aussi statique. Si ces commentaires semblent justifiés quant à l'aspect exposition de ces collections, c'est mettre de côté l'aspect mise en valeur de celles-ci: tout au long du XIXème siècle, ces instruments seront l'objet d'une pratique pédagogique (fonctionnant lors des cours dans l'amphithéâtre jouxtant le cabinet), d'une pratique vulgarisatrice (lors des cours ou démonstrations publiques), d'une pratique scénique (lors des présentations et spectacles de fin d'année scolaire). Contrairement à ce qui se passe dans les cabinets de sciences naturelles, les instruments scientifiques du cabinet de physique ne serviront pas à une pratique scientifique. Ce phénomène est général dans les collèges et séminaires du Canada-Français de même qu'à l'Université Laval.

Les recherches en archives sur la collection du Séminaire de québec, qui deviendra aussi celle de l'Université Laval à sa fondation en 1853, ont permis de dégager certaines caractéristiques de l'évolution ou de la dynamique de la constitution de celle-ci. En voici les principales:

Motivation pédagogique: Les quelques instruments scientifiques de la colonie à la fin du XVIIIème siècle sont directement liés soit à une pratique scientifique en dilettante de quelques élites des classes sociales supérieures, soit à la pratique d'une science appliquée à la navigation, à l'arpentage, à la cartographie. Dans la foulée

européenne de l'époque, l'enseignement classique de la philosophie ouvre une porte à l'enseignement d'une science expérimentale vers cette période; sous l'impulsion de Jérôme Demers, au Séminaire de Québec, la pedagogie des sciences utilisera la reproduction d'expérience comme mode d'apprentissage. D'ou naîtra la necessité d'acheter, de fabriquer, ou de faire fabriquer les instruments nécessaires à un cours complet de "physique". Dans le contexte canadien-français cependant, cette motivation jouera un rôle de plus en plus secondaire. Le programme de physique, créé par l'abbé Demers, ne changera pratiquement pas pendant plus d'un siècle.

Motivation sociale: Il y a apparition, aux débuts du XIXème siècle d'une nouvelle bourgeoisie canadienne-française: elle ne se fonde pas sur son sang bleu ou sa généalogie, ni sur sa propriété foncière ou son capital. C'est la bourgeoisie des professions libérales qui établira sa légitimité par une culture d'élite. Elle partagera avec le clergé un tronc commun de formation collégiale puis universitaire qui deviendra le "cours classique" que nous avons connu jusqu'à la Révolution Tranquille. Cette nouvelle clientèle amènera un accroissement important du nombre de collèges-séminaires sur le territoire. Les sciences, toujours enseignées en seconde année du cours de philosophie, soit la dernière année d'étude, constitue le "nec plus ultra" du programme d'enseignement et de la culture de l'élite culturelle de l'époque. Le cabinet de sciences et particulièrement celui de physique devient en quelque sorte le temple ultime de cette culture. Les institutions, après 1835, investiront de façon importante dans leurs cabinets de sciences, notamment le Séminaire de québec, toujours considéré comme la première institution en importance au Québec; en 1843, on pourra affirmer que la collection d'instruments de Québec, "n'est surpassée par aucune autre en Amérique".

Motivation institutionnelle: La création en 1853 de l'Université Laval, qui sera la seule université francophone du Québec jusqu'en 1919, et à laquelle seront affiliés tous les collèges, entrainera des investissements importants dans le cabinet de physique. Près de 10% du budget total (incluant les salaires) de l'institution sera consacré à ce cabinet entre 1853 et 1863. Le séminaire et l'université prendront alors fierté à affirmer que leur cabinet de physique est "l'un des plus riches et des plus complets en Amérique". Des difficultés à vivre l'affiliation avec les collèges, la querelle Montréal-Québec sur le caractère monopolistique de l'université sont à mettre au compte des débuts d'un déclin dans les politiques d'acquisition après 1875. L'acquisition de nouveaux appareils cessera presque complètement après 1900. Quand l'Université reprenda ses investissements après 1925, ce cera surtout dans la constitution de laboratoires et dans des secteurs souvent nouveaux (génie, agriculture, chimie appliquée, et autres) qu'ils seront concentrés.

Motivation individuelle: La collection du cabinet de physique a toujours été placée sous la responsabilité du professeur de physique. En 125 ans, 5 individus se

succèderont à ce poste: Les abbés Demers, Casault, Hamel, Laflamme et Simard Seront les dignes représentatns d'un modèle Prêtre-Enseignant-Vulgarisateur-Conservateur qui sera aussi le modèle du physicien québécois du XIXème siècle. L'autonomisation relative des champs de pratique, d'enseignement et de vulgarisation rendra ce modèle obsolète apres 1900; un "scientifique" tel l'abbé Simard n'accèdera qu'à la section I de la société Royale du Canada (Lettres, philo, archéologie et sujets connexes), alors que ses prédécesseurs Hamel et Laflamme auront accédé respectivement aux sections III et IV de la Société. Cette obsolescence sera parallèle à la diminution d'intérêt flagrante dans le cabinet et sa collection.

Motivation liée a l'état général des connaissances: Ce facteur scientifique et technique est souvent considéré comme l'unique moteur de la dynamique des collections scientifiques; il n'est pas le seul, mais conserve cependant son importance comme j'ai pu le constater lors des recherches sur la collection de Québec. Le développement de l'électricité, du magnétisme, de l'accoustique et les progrès de l'optique dans la première moitié du XIXème siècle en Europe, amènent un intérêt nouveau pour ces questions. Si cet intérêt ne se traduit pas par un changement important du contenu des cours, il apparait dans l'acquisition importante d'instruments dans ces branches de la physique. La seconde moitié du XIXème siècle sera surtout marquée, quant à elle, par la science appliquée: photographie, phonographie, télégraphie, rayons-x, éclairage acétylène et électrique seront quelques-uns des secteurs clés d'acquisition d'instruments.

Ces quelques réflexions sur la dynamique que j'ai observé pour la collection d'instruments scientifiques du Séminaire de Québec, permettent de dégager certains éléments propres à nous éclairer sur les fonctions d'une telle collection, sur les fonctions de cette première forme de muséologie scientifique et technique chez nous. Ces fonctions, je les rangerais sous les vocables de manifestes et de latentes. Les fonctions manifestes regroupent tout ce qui concerne l'utilisation des instruments: les expériences qu'ils permettent de reproduire, les principes physiques qu'ils permettent de matérialiser, les cours, les démonstrations, la pédagogie des sciences ou ils trouvent place. Les fonctions latentes regroupent tout ce qui concerne la collection, l'exposition des instruments: le prestige de l'institution et de ses membres, la légitimation de la culture d'une classe et de sa représentation partagée par les collectionneurs et les étudiants ou visiteurs qui ont acces aux instruments, la représentation de l'ordre divin projeté dans l'ordre social et l'ordre naturel bien visible dans ces vitrines, leur architecture et dans le discours qu'on tient en ce lieu.

Ces quelques constations sur une collection du XIXème siècle permettent, il me semble, de dépasser la simple compréhension d'un phénomène passé, celui des

cabinets de physique et d'un certain type de muséologie. Par l'examen de la dynamique du phénomène, elles permettent de jeter un regard plus éclairé sur l'ensemble des phénomènes de muséologie, de collection, de conservation de notre patrimoine scientifique et technique. Un débat toujours d'actualité, si l'on en juge par le dossier de la défunte Maison des Sciences et des Techniques ou encore par votre participation à cet atelier.

WHAT'S NEW AT THE OLD BUN FACTORY?

Paul Donahue

The National Museum of Science and Technology is very successful; about 900,000 visitors per year attest to this (as of 1986). People enjoy the interactive exhibits and large, beautiful artifacts. It is not a threatening museum. The average visitor remarks, "Great fun, learned a lot". The collections are good, wide-based and generally well cared for. Registration or collections management system is probably one of the best going. - Why tinker with success?

At issue really is what constitutes success or effectiveness. High visitation, high repeat visitation and happy visitors are one measure. By other criteria, we do not measure up. NMST does not have a strong and long history of publications, or an enviable conservation record; our curators do not regularly offer weighty, academic lectures; the museum does not provide exhibits on the impact of technology; exhibits do not normally address ethical issues nor do they normally promote an awareness of science and technology in Canada and NMST is not an integral part of the museum/academic/ scientific community.

Does it matter? We are a successful museum. Yes, it does matter. It matters that the National Museum of Science and Technology, the only broad-based science and technology museum in Canada does not measure up to our public responsibility.

Scientific literacy

Science Council of Canada Report #36, **Science for Every Student** notes that in Canada today "Science is rarely adequately taught in elementary school, enthusiastic students are not challenged, the crucial interaction among science, technology and society is not taught, and females are turned off science" (p.10). The Science Council recognized that "In order to cope with social changes routed in highly specialized technologies, citizens need an education which includes science and technology" (p.9). Similarly, the American Association for the Advancement of Science, and the U.S. National Science Teachers Association adopted the proposition that "every child shall study science every day of every year" (p.10). NMST can and must assist all Canadians to achieve a higher level of scientific literacy through more thought-provoking, better researched exhibits, plays, books, lectures, demonstrations, etc.

The 1972 UNESCO Report, Learning to Be, stated in part that ... understanding of technology is vital in the modern world and must be part

of everyone's basic education for lack of understanding makes one dependent on others and more vulnerable to unrestrained applications of technology. Education in technology at the conceptual level should enable everyone to understand the ways in which he can change his environment (p.66).

Similarly, the 1975 Symons Report, To Know Ourselves, concluded that "Canadian school children learn virtually nothing about the accomplishment and impact of science in their own country" (p.162). Quite simply, Canadian school children are learning of science in countries other than Canada.

In Canada, we are actively developing into a nation of science and technology illiterati. Why? "Because it scares us; we don't understand it; "It's too complicated"; "Others are teaching science"? We have to overcome these fears. Museums have to work with the educational community in getting the message across. We can supply the necessary information through publications, plays, exhibits, etc.

Science and technology is not yet part of our culture - this must change. It can only change on the basis of solid research.

Impact

Not far removed from the issue of scientific literacy is that of impact. Science and technology regularly impacts upon all people. In order for people to impact upon science and technology, they must have a conceptual level of understanding about it. The acquisition of knowledge of science, i.e., scientific literacy, is simply not enough. The impact of science and technology upon society must be understood in the past, present and future.

People must acquire sufficient knowledge to be able to generally understand the pros and cons of scientific and technological issues such as nuclear energy, environmental controls, food additives. We cannot afford nor can be responsibly advocate only one side - the positive side - of scientific and technological issues. We must provide people with the knowledge and the facts to debate the issues. To do any less, betrays the public trust and puts us in the role of a mountebank. Alice Carnes (1986) in her recently completed study of science museum mission statements concluded that she was troubled and uncertain about the future of institutions that by and large fail to address central contemporary questions about science and technology and the fact that institutions usually don't consider ethical problems the subject matter raises. Carnes quotes the Franklin Institute Science Museum's Director, Joel Bloom, who stated "Science museums must tell people about the promises and limits

of science. It is complex, loaded and value-systems laden. Science museums can't address science and technology in a vacuum".

Nationalism

As an immigrant, it is my personal observation that Canadians, by and large, do not reflect the self-confidence and arrogance that Americans do in the area of science and technology. Frequently, Canadians assign themselves to second class seats when they have every right to be flying the plane. In part, this is Canadian good manners, in part, it's self-effacement coming out of ignorance of one's self-worth. As recently as February 1987, the House of Commons Standing Committee on Research, Science and Technology concluded that one of the major policy issues facing Canadians is a national inferiority complex. When one uses science texts from another country which provides examples of accomplishments from that country, and when the teacher is not informed of what Canadians have done it is easy to understand why Canadians tend to deprecate their own achievements. They do not know of these achievements.

There exists a little book entitled "The Canadian Inventions Book". The authors wanted to tell Canadians more about their scientific and technological history in an easy to digest fun manner. They found that information on Canadian inventions is not easy to locate. Many inventors did not document their findings very well and some of the pre-confederation patent office records are missing. Also, some people are aware, in 1903 the patent office disposed of numerous models of Canadian inventions. This is especially significant in that prior to 1893 working models had to accompany a patent request.

There must be more books of this kind for children to learn about Canadian achievements in science and technology. Our role must be to undertake the research to educate the public about the value of science and technology. Canadians cannot value their contributions globally if they are unaware of them. Concomitantly, Canadians cannot value themselves if they are unaware of their contributions. Nationalism can have a very ugly, egocentric side to it, but a little self-pride is better than a kick in the teeth any time.

Resource management

Museum exhibits normally utilize three-dimensional artifacts to convey the message. At NMST artifacts are collected in order to preserve and retain

elements of our scientific and technological heritage. They are as much an element of study or discovery as business records, journals, photographs, blue prints and other forms of recorded communications so esteemed by researchers. In order to properly utilize artifacts, we must collect, preserve, record and understand them. In so far as possible, they must be placed in context. Furthermore, they must be placed in an environment conducive to their preservation and they must be readily accessible to researchers.

Research cannot, however, stop at the artifact level. It must delve into larger areas and focus upon social and economic implications lest it be a sterile description of old things (CF. Finley 1985). Research cannot simply constitute regurgitations of previous publications. It must emphasize originality, and it must be historiographical sound. Research must substantially contribute to our understanding of the artifact, the people and industry that created it, the society that adopted or rejected it and to research methods.

Lastly, the results of research must be made available to educate the public at large. An indirect way to do this is to produce and share research studies with other museums. This is especially critical for those smaller museums and science centres that cannot afford researchers. We must work with others for the benefit of all.

We also have a role to play here in the areas of registration and conservation, both of which NMST is or soon will be playing a leadership role. As to proper storage or collections, it is imperative that national standards be established and adhered to. All too frequently, collection storage or maintenance gets short shrift. Policies and funds must be put in place. As a case in point, it will take three people labouring 20 years to undertake condition reports, and cataloguing of NMST's collection to bring it up to date.

How do we do it?

I have spoken here of a number of things we should, can, will, and must do. Nothing but words if mechanisms for producing the results are not found.

Museums are educational institutions. When all is said and done, the only reason they exist is for the knowledge benefits to be derived from them. Public museums are owned by their public and ultimately allegiance is owed to that public.

As stated at the outset, NMST is the only broad based science and

technology museum in the country. It is also a National museum. Consequently, staff - especially curatorial staff - are responsible for assisting all Canadians in understanding the interrelationship of science, technology and society (past, present and future).

Thus far, we have not met this responsibility as best we might. I like to think that this is about to change. For example, we now share responsibility and cost for the Material History Bulletin; have brought on a permanent, full-time historian of science and technology whose mandate is to address larger historical themes and ones which cross-cut curatorial areas; are in the process of publishing two books - one by Normal Ball on 100 years of engineering In Canada and the other by Doris Jelly on Canada's role in space. Recently, our Director, Bill McGowan, brought scientists, politicians, educators and industry representatives together to fête Dr. John Polanyi, Canada's most recent nobel prize winner. Curators of NMST now have publications built into their work plans and are required to put forward research projects for funding. Peer review will shortly be built into the review process. Also, collection, research and conservation policies are in various states of completion. Curators have been requested to develop a collections "Hit list", i.e., priorize and rationalize what should be added to and/or remain in the collection. Where possible, we want to share the collection with other museums, perhaps as more of a central repository. NMST has a very effective computerized registration system on which our registrar is currently completing an article for publication. It is our hope to be able to market the system. At present, we are undergoing reorganization in order to more effectively group our curatorial areas. To this end, we have or are developing senior curatorial positions in communications and space, energy, transportation and industry.

We cannot single handedly educate Canadians about science and technology. We need to work with associations, universities, government departments and crown agencies, and the private sector. For example, we plan to assist the Canadian Science and Technology Historical Association in hosting their annual meeting. A small gesture, but I think an important one. Universities can undertake joint research projects with us. For example, theses directed towards science and technology. The Department of Agriculture has already worked with us in developing the very successful Agriculture Museum at the Central Experimental Farm, and the Saunders Exhibit which was a major part of the 100th anniversary of research at the Central Experimental Farm in Ottawa. The Central Experimental Farm gets a great deal of visitation on a yearly basis. Many, many people go there on a pleasant Sunday afternoon looking for something to do. It's a good place to educate people. We hope to work more closely with the National Research Council in the

future, in order to communicate what exciting things happen there, and we have undertaken secondments, i.e. shared person years, with at least four other departments. We very much intend to develop close ties with the private sector that we might also communicate what innovations are happening that area.

Close ties do not automatically translate into "Give me your money". It also means "let's work on a research project together" as we are doing with the "Archives Nationales du Quebec - Centre de Hull"; or: "let us have your prototype or old equipment", as we are doing with government departments and numerous private sector companies. For the Medical Research Council in Toronto, it meant providing resources for a post doctoral student in Medical History to be located at NMST.

NMST is Dismally short of the financial resources necessary to do the job that must be done. NMST has 80% of all National Museum visitors and 7% of funds. The sheer cost of mounting major permanent exhibits prohibits us from doing so using only our own resources. Clearly, we must look to charging for special exhibits, renting artifacts, marketing products and services such as the steam train, and to working with others to jointly develop exhibits and facilities.

The support of research and recognition that curators form the foundation of the museum must be recognized and resources provided. It cannot keep taking second place to public programming.

We are painfully aware of the old adage "Whose bread I eat, his song I sing" and intend to make every effort to avoid the ethical pitfalls. Howard Learner's "White Paper on Science Museums" (1979) discusses at great length the obligations we have to "Fairly reflect the diversity of community viewpoints on controversial issues" (p.3). It is very easy to betray the public trust and put forward a biased forum. The key to keeping ones moral virginity intact is to develop a contractual relationship with partners which is compatibly structured and guarantees the museum the independence to present exhibits that function as objective educational devices.

I have attempted here to point out <u>why</u> research, that is, to what end. Governments must have an end reason for funding research and maintaining collections because in and by themselves they garner little direct publicity or votes. Museums, especially those focused on science and technology must fairly and objectively educate the public and raise the level of scientific literacy in Canada. People must understand the impact science and technology

have on them and vice-versa.

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LE PATRIMOINE DE L'INDUSTRIE: UN CHAMP D'HONNEUR OU D'OUBLI?

Louise Trottier

L'apparition du patrimoine industriel dans le domaine de la recherche scientifique et de son application est le résultat d'une prise de conscience qui s'est manifestée, au cours des vingt dernières années, surtout dans les pays post-industrialisés. Cette prise de conscience a été générée par des facteurs d'ordre politique et socio-économique: la renaissance de l'Europe et du Japon après la seconde guerre mondiale, le vieillissement des structures de production mises en place au XIX^{e} et au début du XX^{e} siècle, leur transformation accélérée, la croissance urbaine, l'apport du nucléaire, enfin, l'impact de ce virage industriel et technologique sur l'environnement naturel, humain et culturel.

Vivre au rythme des nouvelles technologies, certes, mais qu'en est-il de celles qui les ont précédées et engendrées? Dans quelle proportion correspondent-elles à des technologies anciennes? Quels champs d'étude sont les plus susceptibles d'apporter des connaissances à leur sujet? Comment peuvent elles s'intégrer à l'héritage culturel de l'humanité? A quelles normes de conservation et de mise en valeur cet héritage particulier peut-il obéir? Quelle en est la portée éducative?

Ces préoccupations ont été exposées régulièrement, depuis les années 70 tout au moins, dans nombre de conférences internationales, de publications, de même qu'à l'intérieur d'associations scientifiques. Elles ont permis de délimiter le champ d'action du patrimoine industriel, d'en définir les orientations, la méthodologie, et de suggérer des politiques visant à en assurer la protection, la réutilisation et l'interprétation.

La définition du patrimoine industriel représente donc un des premiers résultats de ces débats. Référant aux témoignages appartenant à notre civilisation pré-industrielle et industrielle, il regroupe: des ateliers, manufactures, usines, leurs installations et environnement immédiat; les équipements, machines, outils, produits; l'habitat et les lieux assignés aux services publics, notamment dans les communautés industrielles; la documentation pertinente à ces objets et structures ainsi que les témoignages associés au savoir-faire ouvrier, aux traditions et innovations techniques.

Conséquemment le patrimoine industriel appele donc la contribution d'une variété de disciplines. D'une part, lorsqu'il est intégré à des programmes de recherche et d'enseignement, les méthodes d'analyse et d'inventaire préconisées par l'archéologie industrielle peuvent servir de complément aux études en histoire économique, sociale, des sciences et de la technologie, de

la culture matérielle ainsi qu'en ethnologie. D'auture part, les diverses options à envisager dans l'évaluation patrimoniale des structures industrielles, leur réutilisation et leur réinsertion dans le tissu urbain, la conservation et l'interprétation des collections d'objets significatifs font généralement appel aux disciplines afférentes à la muséologie - conservation, expositions, programmes éducatifs, communication - à l'architecture, à l'urbanisme et à l'ingénierie.

Dans le contexte québécois, des interventions liées à l'étude, la conservation et la mise en valeur du patrimoine industriel ont été initiées depuis les années 1980, notamment à l'intérieur d'organismes gouvernementaux, de musées, et d'universités, d'associations professionnelles, de collectivités locales et régionales, des groupes communautaires, de sociétés historiques ainsi que dans l'entreprise privée. Ces interventions ont participé, en outre, à la désignation de sites industriels représentatifs de notre patrimoine, effectuée respectivement par le ministère des Affaires culturelles du Québec et le ministère fédéral de l'Environnement.

En outre, des thèmes pertinents à l'histoire et à l'archéologie industrielles du Québec ont été soulevés dans des études spécialisées, dans la production d'inventaires, et lors de recherches sur le terrain, dans des expositions, et dans l'établissement de réseaux de tourisme industriel. Ces thèmes ont porté, entre autres, sur l'exploitation des sources d'énergie et des matières premières, les voies et moyens de communication, l'industrie minière et manufacturière, ainsi que sur les communautés ouvrières.

Cette grille nous est donc apparue la plus logique pour décrire, dans les pages qui suivent, les projets accomplis au cours des sept dernières années dans l'ensemble de la province. Nous avons sélectionné ceux qui se sont distingués particulièrement au niveau de recherches, de publications, d'activités muséologiques ou de programmes d'interprétation.

L'exploitation des sources d'énergie et des matières premières compte parmi les secteurs les plus représentatifs du patrimoine industriel du Québec. En sont témoins les projets mis de l'avant par la société d'Etat Hydro-Québec qui, depuis 1983, a procédé à l'inventaire de ses propriétés et bâtiments - centrales, postes de transformation, réservoirs, ouvrages de retenue et de canalisation, lignes de transmission - et de ses équipements, en vue d'adopter une directive corporative pour en assurer la protection et la mise en valeur. A ce jour, les chercheurs ont recueilli des données historiques, architecturales et techniques sur les installations de Chelsea, Rapides-Farmers, Les Cèdres et Sherbrooke.

D'autre part, l'interprétation du méga-complexe de Shawinigan Falls,

regroupant des centrales hydro-électriques et des usines de pâtes et papiers, ainsi que des entreprises reliées aux secteur de l'électro-chimie et de l'électro-métallurgie, est assurée par une corporation locale qui agit de concert avec la Société d'État, les entreprises mises en place - soit l'aluminerie Alcan et la compagnie papetière Consolidated - Bathurst - le ministère des Affaires culturelles du Québec et l'Université du Québec à Trois-Rivières.

Dans le secteur de l'industrie minière, des travaux de recherche archéologique, historique et de stabilisation des vestiges ont été conduits, depuis 1966, sur le site des Forges du Saint-Maurice, successivement par le gouvernement du Québec et le ministère fédéral de l'Environnement; cet organisme est actuellement responsable des programmes d'interprétation. Situé à 13 kms au nord de Trois-Rivières, ce parc historique national conserve les vestiges de la première entreprise sidérurgique canadienne dont les activités ont eu cours entre 1729 et 1883.

Bénéficiant de l'énergie hydraulique fournie par la rivière Saint-Maurice, du bois, du minerai des marais et de la pierre provenant des régions avoisinantes de Batiscan et Shawinigan, l'établissement des Forges comportait trois structures industrielles majeures assurant la fabrication de la fonte et du fer, en utilisant le charbon de bois comme combustible.

Construit en 1736 et occupant une superficie de 825 mètres carrés, le complexe du haut-fourneau est caractérisé par les vestiges de fondations originales en maçonnerie, de halles, d'une moulerie, de canaux et d'un creuset. Cet ensemble a été aménagé, depuis la fin des années 70, en un centre d'interprétation illustrant les procédés d'extraction et de transformation du minerai de fer de même que le travail des artisans.

Deux forges servant à l'affinage de la fonte, édifiées sucessivement en 1739 et 1740, et réaménagées à la fin du XIX^{e} siècle, sont aussi intégrées aux programmes d'interprétation "in situ" tout comme les restes de bâtiments associés aux services administratifs - telle que la Grande Maison - à l'approvisionnement, à l'habitat et au culte.

Parmi les témoignages qui sont significatifs de l'évolution des transports au Québec se trouve le Musée ferroviaire canadien, situé au sud-ouest de Montréal. Son emplacement rappelle le tracé de la première voie ferrée dans les colonies britanniques de l'Amérique du Nord; inaugurée en 1836, elle s'étendait entre Laprairie et Saint-Jean.

Ce musée a été fondé en 1961 par l'Association canadienne de l'Histoire du chemin de fer. Actuellement des membres de cette association, des professionnels et bénévoles en gèrent les activités. Le site regroupe, entre

autres, une plaque tournante, un parcours de train et de tramway - qui fonctionne pendant la saison estivale - la gare Barrington, datant du XIX siècle, des aires de détente et deux réserves abritant les collections. Celles-ci sont composées surtout de matériel roulant provenant des compagnies Canadien National, Canadien Pacifique et Montreal Transit Corporation. En outre des exhibits associés à la technologie ferroviaire sont présentés dans un centre d'interprétation où sont conservés des documents d'archives.

Le remorqueur T.E. Draper, ancré sur la rivière des Quinze bordant la petite agglomération d'Angliers au nord-ouest du Québec, a été soumis à des travaux de stabilisation ainsi qu'à des programmes d'interprétation menés conjointement par la municipalité et le gouvernement provincial. De 1929 à 1950, le remorqueur était engagé dans le flottage du bois sur un réseau de lacs reliant les régions du Témiscaminque et de l'Outaouais supérieur; ces opérations ont été menées principalement par deux compagnies papetières, la Riordon Pulp & Paper et la Canadian International Paper.

Le site de la Vieille Pulperie de Chicoutimi est associé à l'industrie des pâtes et papier qui s'y est développée entre 1897 et 1943. Oeuvre de l'architecte René P. Le May, ce complexe manufacturier comportait 5 bâtiments édifiés successivement entre 1897 et 1923. Y étaient concentrées les opérations de transformation des matières premières - coupage, écorçage, défibrage du bois - ainsi que la fabrication de la pâte mécanique et chimique. Un atelier de réparation et un poste de transformation électrique complétaient les installations. En outre, des ouvrages hydrauliques - barrages, écluses et conduites forcées - alimentées par le débit de la rivière Chicoutimi s'ajoutaient aux voies ferrées et aux chemins de desserte.

Des projets de conservation et de mise en valeur de ce vaste ensemble industriel ont cours depuis 1979, particulièrement au niveau de la recherche historique, archéologique, de l'interprétation et de la réutilisation des bâtiments à des fins culturelles. Ces programmes résultent de l'action concertée des autorités municipales, d'une corporation locale, d'organismes des gouvernements provincial et fédéral.

L'arrondissement historique de Vieux-Québec a connu de façon sporadique, entre le XVII^{e} et le XX^{e} siècle, des activités industrielles concentrées dans la fabrication de la bière. Ainsi en témoignent les recherches archéologiques qui, depuis, 1982, sont effectuées sur ce site par l'université Laval en collaboration avec la Ville de Québec et le ministère provincial des Affaires culturelles. Ces recherches ont mis à jour des planchers, des murs, des piliers, des puisards ainsi que des voûtes associées aux chambres froides, aux unités d'entreposage, d'embouteillage, et aux bâtiments de service édifiés pendant la période des opérations.

Sous l'initiative des autorités coloniales françaises, une première brasserie était en fonctions entre 1669 et 1675. Par la suite, l'édifice a été utilisé comme palais résidentiel par les intendants de la Nouvelle-France, détruit par des incendies (1713 et 1845) ou encore par des bombardements (1759 et 1775). Une occupation industrielle est associée aux brasseries implantées respectivement par John Knight Boswell et ses descendants (1852-1952) et par la compagnie Dow (1952-1970). La cessation des activités de cette brasserie - absorbée par une entreprise multinationale - a amené la démolition de ses bâtiments. Devenue propriétaire du site en 1977, la Ville de Québec a favorisé les travaux archéologiques et installé un centre d'interprétation dans l'ancien Palais de l'intendant.

L'Écomusée de la maison du fier monde, situé dans le Centre-sud de Montréal, a été créé en 1980 par des résidents et des groupes communautaires soucieux d'étudier, de conserver et de diffuser, par des expositions et des programmes d'animation, certains chapitres de l'histoire industrielle de leur quartier. Dans ce contexte, des thèmes tels que "Rues et pignons" portant sur l'habitat ouvrier, "Les jeunes et la crise", "Voyage dans le Centre-sud", "Entre l'usine et la cuisine" ont été traités dans des expositions, des brochures de même que dans l'organisation de visites quidées.

Enfin l'action menée par des entreprises d'envergure, ainsi Alcan, Bell Canada, Domtar, Johnson & Johnson, la brasserie Molson et les Tabacs Macdonald, mérite d'être soulignée en ce qui concerne notamment la préservation de leurs archives, leurs collections d'objets techniques ou encore la réfection de leurs installations.

Pour conclure

Parmi les actions pouvant être envisagées dans la préservation du patrimoine industriel québécois se trouve, en premier lieu, le regroupement des efforts de tous les intervenans engagés dans des projets pertinents. Cette communication a fait état des préoccupations d'un nombre croissant d'individus dont la plupart oeuvrent, certes, en milieu institutionnel mais proviennent aussi de groupes communautaires ou associés à l'entreprise privée. Dans ce contexte il faut souhaiter la formation d'une association professionnelle ou scientifique dont les objectifs spécifiques veilleraient à promouvoir l'étude, la connaissance, la protection et la mise en valeur du patrimoine industriel au Québec et à encourager toute activité educative et de diffusion en ce sens.

Il serait opportun, en deuxième lieu, que soit aussi assurée, par la mise en commun de ressources financières, humaines et matérielles, la collaboration entre des universités, des centres de recherche, des

établissements muséologiques et des entreprises privées dans la poursuite de projets multidisciplinaires se rapportant au patrimoine industriel du Québec. Ce contexte pourrait favoriser la réalisation d'un inventaire de ses composantes, non seulement de bâtiments, d'équipements ou de machinerie, mais aussi d'objets techniques et industriels susceptibles d'être intégrés à des collections de musées, et les documents d'archives s'y rapportant. De façon stratégique, cet instrument de recherche pourrait servir de support à l'élaboration de critères visant: la conservation préventive - totale ou partielle - des structures, les orientations à suivre dans la réutilisation ou le recyclage des bâtiments, le développement rationnel de collections muséologiques, l'interprétation des vestiges "in situ".

En troisième lieu une oeuvre de diffusion des connaissances relatives au patrimoine industriel québécois doit être entreprise. Elle pourra être encouragée par la production d'études spécialisées, de publications populaires, de documents didactiques et audio-visuels. D'autre part, les préoccupations actuelles de la population face au virage techno-industriel pourraient être évoquées davantage dans des programmes d'exposition. En plus des thèmes qui ont déjà été identifiés dans cette communication, et qui se rapportent aux industries des secteurs primaire et secondaire, nous pensons à ceux qui évoquent également le secteur tertiaire, comme par exemple: les services de santé et médecines alternatives, l'environnement (décontamination et recyclage des déchets industriels), les nouvelles formes d'énergie, l'informatique, la robotique et la télématique.

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SESSION V

SHARING KNOWLEDGE WITH THE PUBLIC: PROBLEMS, THEORY, AND PRACTICE

(Chairman: W. Case)

Speakers:

Jacques Desautels: Manuscript not available.

Leslie H. Patten: "Introducing science to the arts of exhibiton design."

T. Semadeni: "A science museum with no collections."

INTRODUCING SCIENCE TO THE ARTS OF EXHIBITION DESIGN

LESLIE H. PATTEN

It is my task for the workshop to look at issues, not in the sharing of scientific knowledge, but in the science of sharing knowledge.

I take it as given that one of the main functions of museums is to encourage visitors to discover things of significance about science - to play the different "games" of knowledge, as Jacques Desautels explained it; or, as Paul Donohue argued yesterday, to help promote science literacy.

But how do we do this? How do we share knowledge and perspectives and processes through exhibits so as to achieve our aims? Do we know? We have no shortage of expert opinions about what is effective, and what isn't. I do not wish to underplay the very important roles of talent and experience in sharing knowledge, but what do we really know about how it happens in the informal museum environment?

In the view of a growing number of museum professionals, there are questions that deserve to be addressed by what we call visitor-based research. What motivates people to visit museums? What is the nature of visitors interaction with museums? How do visitors use museum exhibits? How do communication and learning occur in museums? What are the sources of delight and enjoyment?

Answers to such questions would help to direct and improve our efforts to share knowledge in all disciplines, science and humanities.

I find it useful to look at the way museum exhibits used to be developed in contrast to the way we are trying to develop them now, as a way of getting a grasp on the current state of the art - and science - of sharing knowledge in museums. In the past, exhibits were typically conceived and planned by curators. The curator figured out the best way to organize the display of objects or specimens so that it reflected his or her discipline, and although she/he relied on the skills of artists and designers to help implement the plan, she/he alone decided what to communicate, and, in every important respect, how to communicate it. We can think of this type of exhibit design as "curator centred"; it is a model of one-way communication from the curator to the audience, on the museum's terms alone.

In contrast, several museums have been trying for the past decade to evolve a "visitor-centred" approach to designing museum exhibits. The visitor-centred approach is a model of two-way communication, with scientific information about visitors and their behaviours in museums being equally important to design decision-making as the curatorial definition of what content should be conveyed.

It is with the adoption of this visitor-centred approach that we may talk about a "science" of sharing knowledge joining the more traditional arts of exhibit design. In trying to understand how to reach museum visitors, how to take their needs, interests and behaviours into account, we have begun to use techniques of the social sciences to survey our audiences, to study motivations and attitudes, and to investigate the ways people enjoy themselves and learn things in museums, and to evaluate the effectiveness of our exhibits and programmes with their audiences.

One of the most important things to state about the emerging museum-based science of sharing knowledge is that there are no general or overarching theoretical frameworks within which to conduct our studies of museum visitors. There is no Darwin of museum studies; we have virtually no research-based theory of museum visitor behaviour or of museum education.

Investigation of museum audiences and their interactions with museum exhibits may eventually lead towards general theories. Over the past decade the number of research studies has increased tremendously, and some of the work is promising. The studies of Marilyn Hood at the Toledo Museum of Art, and the studies of Bob Kelly out of the UBC Museum of Anthropology, for example, point towards a theory of motivation for visiting museums of art. The work conducted by Mick Alt just before he left the BM(NH) makes an exciting start at a theory of visitor behaviour in museum galleries - the theory of competition, as Alt calls it. But such work is still rare.

It is noteworthy that our main accomplishments in the science of sharing knowledge have followed comparatively long-term programmes of inquiry. Alt's work, for example, followed nearly ten years of visitor surveys and evaluation studies at the BM(NH).

So many variables affect visitor behaviour that it is only by conducting observations over a long period of time, in a number of configurations and

with control of some variables, that we learn anything of real value to our practice. This suggests that ongoing programmes of visitor research are crucial to the development of a museum-based science of sharing knowledge. It also suggests that such programmes ought to be among the priorities of science museums. Because we have as yet so few tested theories of museum visitor behaviour, we frequently borrow theories and techniques from other disciplines - chiefly psychology - to create our visitor-centred exhibits and programmes. We have borrowed the theory of discovery learning, for example, to experiment with the design of museum learning environments using participatory exhibits. Similarly, we have borrowed the theory and practice of programmed learning to experiment with the design of instructional exhibits that achieve cognitive objectives without the aid of a live interpreter.

After we've borrowed and applied theories and technique from elsewhere, we sometimes evaluate the resulting products. "Evaluation" is the museum word of the 80's. The problem with most exhibit evaluations is that they are idiosyncratic, "one-off" studies, concerned more with establishing the success or failure of the product for political purposes, than with producing generalizable findings for future practice.

Nevertheless, the growing body of data from these evaluation studies, from visitor surveys, and especially from the few longer-term programmes of inquiry and controlled experimentation, puts us in the position to argue for modest research programmes in our public programming sectors. The BM(NH) is alone in having had such a programme in place for nearly ten years. At least one museum in Canada - the British Columbia Provincial Museum - has just implemented the first stages of an ongoing programme of visitor inquiry. The National Museum of Natural Science and the Royal Ontario Museum could conceivably follow.

I think a great many museum professionals working in public programming have arrived at the point where they want their institutions to take this step of instituting such research. Many believe, in fact that museums must take this step if they are to remain responsible to their publics. We spend millions of dollars annually on exhibits and programmes in museums, and claim thereby to be providing an educational service of value to society. Roger Miles, Head of the Department of Public Services at the BM(NH), and the leader in establishing an institutional programme of visitor-based research, has suggested that most museums are getting their public programming money

under false pretences, since it is uncertain that what they provide is effective for their audiences, and since it is uncertain that their exhibits and programmes are "educational" in any meaningful sense.

Visitor-based research can help us to do a better job in achieving some of our educational goals - there is enough evidence now to convince us that this is true, and even to suggest that some of our goals need reformulating. But perhaps an even stronger argument for visitor-based research is that it may greatly assist us to create public understanding of, and support for, the true nature of the museum enterprise. The need for this understanding and support has been reflected in every session of this workshop. I think it behooves us, in the present critical circumstances of Canada's science museums, to develop a public understanding of the role research museums play in the scientific enterprise and the creation of knowledge.

I will leave you with a few findings from a recent evaluation study at the ROM. Of 125 visitors interviewed before they saw Mankind Discovering, the ROM's introductory gallery which presents the research function of the Museum, only 5% knew that the Museum plays a role in research or the creation of knowledge.

Of 125 visitors interviewed after they had visited this gallery, 19% spontaneously mentioned research, or the creation of knowledge, as one of the main purposes of the Museum. Perhaps even more significant, 22% (from 56% to 78%) exhibited a positive shift in attitude towards the Museum after seeing Mankind Discovering.

If established as an integral part of museum operations, visitor research will help museums deliver more effective exhibits and public programmes. It may also help them to build better public understanding of their value and to encourage support for their future research programmes in science.

SCIENCE NORTH - A Science Museum with No Collections

T. Semadeni

This morning, Spring Equinox, is special because it's when we are reminded of the tilt of the earth's axis. Some of us got up early to witness the easterly rotation of the earth, especially the moment when the horizon just dips down past the solar disk, sunrise. Later I phoned Sudbury and learned that 350 people celebrated the same phenomenon, a few minutes after I did, in balmy -3°C weather. Why do people forego blissful sleep just to watch the Earth spin?

When Jean-Pascal invited me to say something at this very learned and important gathering, I thought it might be presumptuous for a newcomer to this business to add to your collective wisdom. I realized that I was in real trouble yesterday when I sensed that I was the lone physicist among biologists who were setting up a lobby to get public support for a major ongoing collections effort.

Since I'm going to say some things which might sound a bit radical, I'd better first tell you a few of the unique things about the new Science Centre in Sudbury - Science North.

Science North opened in 1984 to great Royal fanfare, with a beautiful building, a few good shows and a good 3D movie. We had an exuberant staff of about 30 people, about 100 active volunteers and vague status as to our operating budget. Our suppliers were at 90 days and we had great difficulty meeting our payrolls. We spent about $100,000 on scientific exhibitry in 1984 and survived with the generosity of the OSC, ROM, NMST, and the National Museum of Natural Sciences. Thank goodness they weren't into user pay then. About a year ago we became an agency of the provincial government.

Science North was built to diversify the Sudbury economy by attracting tourists. Sudbury, a community of 160,000 people, was not known as a tourist destination.

Current Situation:

- 170,000 visitors + 20,000 students + 60,000 at the Big Nickel Mine = 250,000 total annual visitation.
- Admission Fee: $5 adults, $2.50 kids, $1.75 kids (school group rates).
- $65 family membership. About 1500 members, who visit 8.1 times per

year, on average.

- 250 volunteers who give their expertise on a scheduled basis.

The annual operating budget is about $3.1 million of which the Province contributes about $1.7 million. The remainder is earned through admissions and our profit centres. We also work with both senior levels of government to operate a variety of real time scientific systems, such as a seismometer network, an air sampling station, and a few other data gathering systems. It is estimated that Science North generates about 11 million dollars annually of new direct and indirect tourist spin-off into the Sudbury economy.

The Mission of Science North is to **"Provide a program of learning, in French and English, both formal and informal, which involves the visitor in the relationships between science and technology and everyday life, with reference to the North. Science North is a significant attraction to tourists.".** Note that there is no reference to collections, presentations or research. Note, however, that learning involves relationships.

We do however have one collection system called the Science Swap Shop where youngsters bring their collections of natural artifacts in for evaluation and trade. Trading points are given based on the quality of the artifact or specimen, and the degree to which the youngster can describe the specimen and its relationship to other members of the collection. Maybe when these youngsters grow up to become politicians and managers and voters, they will be sympathetic to the pleas which were so eloquently expressed yesterday. One full time staffer and about 20 volunteers run the Swap Shop. About 1250 kids are actively trading this year. Some also come in for weekend or evening workshops.

Getting back to our Mission: provide a program of learning which involves the visitor.

We try to help the visitor put on a lab coat, to probe, to test, to question, to speculate, to experience the good stuff that scientists experience when they do their work.

The fin whale skeleton is a good example. A few summers ago, we sent an expedition to the southern shore of Anticosti Island to retrieve about 80% of a skeleton of a whale that beached a few years earlier. This skeleton reposed in the tailing ponds at Inco, on top of an arena, in wire cages at the bottom of a local lake, and in an area called the Whale Workshop for a couple of years. Along the way, the public was involved in the reconstruction of the skeleton. Teachers, volunteers, staffers, students, and visitors all had aprons

on making casts, drilling holes, doing research, phoning friends at the Ontario Science Centre, or wherever, for help.

The whale skeleton was suspended last October. While it is a magnificent display we, and our visitors, all miss that very special feeling of being part of the process. Incidentally we are planning a context for this whale skeleton with a new visitor experience entitled "Whales of Ontario". That helps us realize that Ontario is a coastal province and that there is a North to this southern part of Canada.

As a brand new Science Centre we are facing some interesting issues:

1. There are strong forces out there to take the science out of this Science Centre:

   a) The EPCOT/WONDERLAND force - fun only for entertainment's sake - bolting of fake rocks, Expo 86 glitz, lots of bells and whistles.

   b) "Let's design and build some world class exhibits here. Lets use lots of graphics, paintings, models, structure, automation and push buttons."

   c) "Let's make sure that **everything** is explained" - what we need is a lot of graffiti in both languages - lots of silkscreen on acrylic. After all, all of our visitors are good readers and love to read!

   d) Let's get some experts in - some exhibit designers.

   e) Let's set a bunch of exhibit standards before we do anything.

You see, you museum folks have conditioned the population by telling them how to behave - feel lots of reverence for the Results of Science, correctly explained.

2. There are a variety of theories competing for the best mode of communication with the visitors.

   scientifically - This impresses visiting scientists.
   didactically - This impresses teachers leading their class through an area.
   print or picture - This illuminates official languages issues and the costs of graphical interpretation.

   face to face - Is the image of our staff that of a security guard? a

tour guide? or a working scientist?

3. How do we deal with the collection explosion or worse, the information explosion? Some empirical answers:

   Don't be taxonomic
   Don't try to be complete
   Do try to be exemplary (It's much better to display the log book for our beaver out than to fill the place with rodents)

I'm confident that other more serious issues will emerge during the discussion.

In the meantime here are some conclusions and recommendations:

- At Science North there is no visitor price resistance to a quality science museum experience.

- A science museum Mission which focuses on the visitor participating in the processes of science rather than the results of science is feasible.

- Science museums can be very significant in engaging people in a "science culture".

- Ways should be found to encourage collaborative activities between "real science" and science museums.

- The Science Council of Canada should encourage science museums, and government and industry labs to involve Canadians in science culture.

(In 1992, five years after this presentation, attendance has increased slightly; an outreach program involving an additional 40,000 people, annually, throughout Northern Ontario, is in place. And a variety of collaborations with various institutions has resulted in visitor experiences that are continuously evolving. – T.S.)

SESSION VI

FINAL PLENARY

(Chairman: M.D.B. Burt)

Speaker:

Emlyn H. Koster: "Summary of the workshop: thoughts for discussion."

SUMMARY OF THE WORKSHOP: THOUGHTS FOR DISCUSSION

EMLYN H. KOSTER

Introductory Comments

- Appreciation to Huegette Guilhaumon
- On behalf of workshop participants, appreciation to Science Council of Canada
- 1986 Statistics survey of Canadian attitudes toward cultural amenities; growth of friends' societies and cooperating associations
- Attempt at synthesis of recurring ideas in a practical sense
- Not feasible, given time constraints, to give individual acknowledgements for source of ideas in workshop
- Adopted a generic approach to synthesis rather than package according to workshop format
- Additional personal thoughts on other important issues

Observations on the General Problem in Question

- Science Council objectives versus workshop participant concerns
- Workshop participant concerns:-

    1. Inadequate recognition of value, of funding, and of policy framework as they affect preservation/conservation/collections activities and the research based on those activities within museum environments.

    2. Inter-relationship of above with university-based collections and research, recognizing problems of no protective mandate at universities for collections and of succeeding faculty.

- How have museums developed this problem? Has it always existed? Most workshop participants have addressed the status quo.
- If a general, pervasive problem is recognized, all interested parties must agree upon, and contribute to, appropriate solutions.

Emlyn H. Koster

Fundamental Concepts in Museum Mandate and Public Image

- Public source of funds, whether directly through line departments or friends' society/ cooperating association contributions, volunteerism. etc..
- Integration and teamwork approach to linked programmes comprising museum:-

  Conservation/ Collections/ Authentification/ Preservation

  Research

  Exhibit Design

  Public Education
- Understanding and optimising quality of impact on visitors.
- Periodic upgrading of exhibits must not allow collections and research activity to become activities divorced from museum mandate.
- Moral obligation to be accountable.

Recurring Issues of Workshops

1. **Attitude, Effectiveness and Organization**

1.1 Individual and collective attitudes; teamwork

1.2 Measures of effectiveness and value of museums

1.3 Context of collections and research activities in museum mandate

1.4 Institutional versus self-directed research

1.5 Museum research reflects purpose of collections

1.6 Advent of high-technology in collections management

2. **Funding**

2.1 Allocation of budget to various museum programmes

2.2 Specific role of N.S.E.R.C.

3. **Policy Requirements**

3.1 Diversity in museum philosophy between provinces

3.2 Parallels between museums of human history, natural history, technological heritage, industrial heritage and herbaria

3.3 Inter-relationships between regional and federal museums in national mandate

3.4 New federal government's strategy for science and technology museums provides model for natural history museums

3.5 Necessity of taxonomy and systematics as baseline data for environmental impact assessments

3.6 Learning optimal philosophy from other countries.

4. **Multilateral Relations**

4.1 Museum versus university collections and research

4.2 Links with other Canadian survey agencies

4.3 Availability of collections to visiting scholars

4.4 Potential for collections work in developing countries

Additional Important Issues from Personal Perspective

- Cultural Tourism
- Enhancing the significance of museum-based research
- Academic standards and salaries of museum researchers

- Credibility of museum researchers; analogies
- Friends' societies and cooperating associations
- Further role for Science Council of Canada; a nation-wide survey of issues raised by this workshop

RESOLUTION

The following resolution, on the next page, was passed unanimously by all participants.

A number of other suggested resolutions met with general consensus and are present as recommendations in several papers. These were not discussed in depth at the Plenary Session and, due to time constraints, were not delineated as specific resolutions for approval. Accordingly, they are not spelled out here.

RESOLUTION

PREPARED BY IAN SMITH

Whereas collections of natural history specimens are the fundamental resource for ongoing systematic research and identification capabilities, and represent the only means for permanently documenting the diversity identity distribution and variability of the species of flora and fauna of importance to Canadians; and whereas the current resource base available to institutions housing these collections is inadequate to ensure that they are developed, cared for, and used to the fullest extent consistent with Canada's essential regional national and international needs; and whereas there is an urgent need for a comprehensive Federal policy framework to promote long-term solutions to the growing crisis facing natural history collections; be it resolved that the Science Council of Canada should take the lead in promoting immediate establishment of a national Advisory Council on natural history collections in Canada, with representation from the various types of collection-holding organizations including museums, research centres and universities. The Advisory Council should have a broad mandate to consider input from the scientific community and the general public and to draft recommendations on the rationale, establishment, scope, development, care, use, and funding of collections with the aim of providing the basis for a statement of Federal policy. A priority should be the establishment of a formal network of Canadian national collections with access to adequate administrative and financial resources to ensure balanced support for the essential regional, national, and international components of the net work.

Passed unanimously

POSTSCRIPT

Several resolutions (9) were passed at the **First International Symposium on the Preservation and Conservation of Natural History Collections** held in Madrid, Spain from May 10-15, 1992. These are reproduced here following a report of the Symposium prepared by Susan M. Woodward (ROM) who was there.

THE FIRST INTERNATIONAL SYMPOSIUM ON THE PRESERVATION AND CONSERVATION OF NATURAL HISTORY COLLECTIONS

Susan M. Woodward

Man is in trouble. For the first time in our existence, the activities of Man rival those of nature in scope and magnitude. Our actions are having a dramatic effect on environments. Biodiversity is being greatly decreased. Museums, over the centuries, have been a private garden for scientists in which few others were allowed to enter. Our hands have been and still are in the public's purse and the public want to know what we are doing that costs so much. It is time for museums to become attuned to the world around them and respond to the changing needs of the world. Research needs to be focused upon the issues that are threatening the long term survival of Man. The traditional methods of collecting, identifying, and describing new species are inefficient and cannot meet the demands of the environmental crisis that faces Earth presently; the use of parataxonomists and collaborative efforts are the means by which we can carry out this global task. Conservation and preservation of museum specimens must be a priority since many of our collections are irreplaceable and house a wealth of knowledge which we will need to determine our future. Exhibits in museums need to be current, reflecting the current changes occurring in the world; they need to present balanced views so that visitors can come to their own conclusions about issues. Museums must play a much more active role in education of the public about the environment and conservation issues. Natural history museums are no longer scientists' private gardens; it is time to let the public in.

These were the take-home messages and recurring themes that were touched upon by many of the museum directors and curators in management positions that spoke at the first International Symposium on the Preservation and Conservation of Natura History Collections. Although the messages were consistent, the content of the individual talks varied greatly. A curator from the Natural History Museum in Vienna, Austria spoke of mismanagement resulting in collections being severely neglected because appointments were and continue to be made on the basis of political affiliations rather than on scientific competence. A person from the national Museum of Natural History in New Delhi, India spoke convincingly about the importance of public education, making the point that conservation can succeed only if it becomes a people's movement. A speaker from the University of Oxford in Oxford, United Kingdom said, "both to understand fundamental aspects of the evolution of diversity, and to manage the biosphere that sustains life on Earth in a sustainable way, we need to know what species are found where." Another speaker pointed out that in physics results must be reproducible at anytime, by anyone to be accepted. If this were true in all sciences there would be no need for collections. Yet another likened our collections to a

library. With the present habitat destruction we are burning books without having read them, or even knowing the titles.

A member of UNESCO spoke very eloquently of the important role museums must play in education. He summed up the problems of translating scientific information into a form that can be digested by the public. He discussed the three main "dimensional problems" that must be taken into account if information is to be meaningfully dispersed. The spatial dimension affecting the thinking of a microbiologist versus that of a forester are remarkably different. Relative differences in the time dimension exist for the hunter-gatherer who survives from day-to-day, the forester who thinks in the range of 30-50 years and the genetic conservationist who looks at tens of thousands of years. Finally, there is the perception dimension regarding the environment and habitats; farmers, foresters, and industrialists do not perceive the environment similarly. These dimensional impediments vary ethnographically. The need for education is given, but we must learn to communicate in common "dimensions" if the biodiversity crisis is to be grasped by the public.

The global consensus in opinions generally expressed at the meetings was remarkable. The points that were made were compelling and rational. The need to take this information from these meetings and put it into action in our own institutions was clear. Nine general resolutions were passed by some 400 delegates (representing more than 70 countries) attending the Madrid meetings (see attached). The intent of these resolutions is to suggest directions that need to be actively pursued to attain our goal of sustainable use of our ecosystems. It is here that I see a major indicator that presently museums are not "doing their jobs" primarily because of a lack of focus and an historical lack of perception that a focus was even necessary.

A member of the Entomology Department of the Smithsonian commented on how in fact we are facing two biodiversity crises; one in the planet's environments and another in museum collections. Many collections are poorly curated and inaccessible to others. Are we busy doing the right things? It was noted how research-driven curators can get territorial when organization (i.e., collection management) threatens their personal agendas. The Smithsonian has instituted "collection impact statements" in which collectors must illustrate that the requirements of preparation, curation, management, and storage of all of the specimens collected from a field trip have been insured. Collecting trips are not authorized by the chairman without these statements having been completed. Upon return to the institution, collections are tracked using a microcomputer database system. The status of collections is tracked by measuring the percentage of the collections that are unprepared, unidentified, identified to genus, identified to

species, installed, inventoried, captured on database, etc. A "collection health index" is calculated and curators are responsible and accountable for their own performance index. These management tools permit progress within departments to be tracked. As a collection manager, I found this system very intriguing since I had developed a very similar tracking system for my department (Woodward, 1990) a few years ago in an effort to be able to manage the processing stages of our backlogged and recently acquired collections. One of the major effects my system has had is that it has made people within the department realize that we are working as a team and that one person's actions/ inactions have a direct impact on another. This system has acted as a communication vehicle that has lead to the significant improvement in the management of our collection. The time has come when museum workers need to focus their activities, become a business in which they are accountable for their work, and use the available technology to improve their organization and efficiency. We can no longer remain a group of eccentrics tolerated and patronized by society. The British Museum is an example of a museum being treated as a business; it has set priorities and has focused on producing products desired by government (society's representative). The world is changing and that changing world cannot tolerate the inefficiencies previously allowed in museums; the issues demanding our attention and expertise are imminent and we can no longer be allowed to take casual walks through our garden.

The presentations at the meetings were from two very distinct perspectives and thus dealt with very different issues. The poster and workshops were presented by collection management professionals and conservators. They addressed fundamental museum and collection management issues. This meeting represented the first real meeting of the Old World and the New World to talk about collection management. All of the workshops were presented by Canadians or Americans. As a result, although very useful, they gave me a detailed understanding of the status of others' collection problems like funding, storage, environmental control, documentation, or automation. The poster presentations were by far the most successful means of dispersing information about activities at museums across the world. Unfortunately, little time was available to study the posters.

All of the spoken presentations were philosophical and realistic treatments of the global and political realities facing museums today. The necessity to change was universally echoed. For me, the voices of the directors and management of institutions carried the dominant messages of this first international symposium. Hopefully these messages will lead to changes in the direction of museum priorities. As incoming chair of the Documentation Committee for the Society for the Preservation of Natural History Collections my goal will be to develop strategies and fulfil relevant

mandates suggested in the Madrid resolutions. As a collection manager these resolutions suggest obvious goals to be attained to improve the accessibility of data contained in my collections and a justification for striving to improve myself and others as professionals. Collection management work should not be done in isolation as it has in the past. New cooperative initiatives need to be nurtured within and between institutions.

The importance of the upcoming Earth Summit in Rio was referred to frequently. The Madrid resolutions will be tabled in Rio. A general belief was voiced by all, that museum collections are the root of our understanding of Earth's ecosystems. Unfortunately the concentration of museums, specimens, and trained personnel is unbalanced due to "our" Imperialist past. The vast majority of collections, curatorial and collections expertise are in the developed areas of the world, while the major biodiversity is in the less developed areas of the world. Museums in underdeveloped areas do not receive funding or staff because the government's priorities must be with feeding their people. Many spoke of a need for more collaborative work to rectify the existing national unbalance and attain a global balance.

I visited the World Exposition in Sevilla after the meetings. As I took the monorail around the 250 hectare site a thought struck me. If we could only harness a fraction of the effort, cooperation, and ingenuity represented by this united demonstration of Man's ability we could achieve so much towards understanding our environment and changing many of our destructive practices.

I hope that we can cut through the counter-productive politics, bigotry, rivalry, and intolerance that most threaten Man moving forward collectively as a species to a sustainable future. We must first acknowledge and understand that these obstacles exist before we can attempt to correct them and move forward. The realization is percolating through to the building blocks of our scientific knowledge that the global problems we now face threaten our species' existence. Museums house representative collections of the biological diversity that we must identify, understand, and manage. As museum management, curatorial, and collections management staff our real challenges are just beginning since the key to our future is likely housed within the walls of our institutions.

Susan M. Woodward

LITERATURE CITED

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ACKNOWLEDGEMENTS

I would like to acknowledge the Bursary Program of MAP and Joe Mandarino, Acting ADC for funding that enabled me to attend these meetings.

RESOLUTIONS FROM THE INTERNATIONAL SYMPOSIUM AND WORLD CONGRESS ON THE PRESERVATION AND CONSERVATION OF NATURAL HISTORY COLLECTIONS

Madrid 15 May 1992

PREAMBLE

"We cannot even estimate the number of species of organisms on earth to an order of magnitude, an appalling situation in terms of knowledge and our ability to affect the human prospect positively. There are clearly few areas of science about which so little is known, and none is of direct relevance to human beings." Peter Raven, 1992

The following issues and recommended actions are made understanding full well that burgeoning world population growth and the associated exponential increase of industrial exploitation of natural resources and energy use is causing an ever-increasing destruction of the world's biodiversity. Knowledge and understanding of biodiversity is essential for the conservation, management, and sustained use of ecosystems. Recent research demonstrates that our catalogues of biodiversity are seriously inadequate (as much as 90% of species diversity is unknown to science) and urgently need to be improved, so that science can place proper value on our natural resources and provide models to predict the consequences of lowered biodiversity. Thus, natural history collections are important for the study of biodiverstiy.

ISSUE 1. THE CENTRAL PURPOSES OF COLLECTIONS: RECOMMENDATIONS TO AID AND MONITOR WORLD-WIDE COLLECTIONS CONCERNS

The central purposes of natural history collections are to record through specimens and related data the existence of species on the earth along with their supporting geological structures, to carry out research on the interrelationships of plants, animals, and minerals, and to communicate this knowledge to serve the needs of society.

The preservation and conservation of natural history collections transcend local or national concerns. Natural history specimens and associated data, housed in museums, document the existence of species in time and space. Museums, then, are libraries of life and supporting geological structures. These resources are essential for expanding knowledge through research and education. Each biological species is an encyclopedia of genetic information; specimens in museums represent volumes of each different encyclopedia. Reference and type specimens within these collections are essential for precise identification of species and strains. Voucher specimens serve to validate biological research by insuring that it can be replicated or compared with future research. Museum holdings cannot be replaced, they are priceless archives.

Contributions emanating from natural history collections contribute significantly to diverse fields such as conservation, agriculture, medicine, toxicology, epidemiology, biochemistry, archaeology, ethnology, economics, commerce, food and mineral resources, and law enforcement. Modern biotechnology is dependent on biological collections.

ACTIONS:

1-1 The Congress, first and foremost, recognizes that the biological species of each country should be considered and respected as cultural resources of inestimable value for the entire world.

1-2 As this first World Congress on the Conservation and Preservation of Natural History Collections, convened in Madrid, Spain in 1992, clearly demonstrated the need for international coordination on

numerous issues, a World Council on Collections Resources (WCCR) should be formed by the Organizing Committee of the 1992 Congress. The WCCR should consist of representatives from those world-wide organizations that are concerned about the preservation and conservation of natural history collections. The WCCR would be established for the following purposes:

(1) to monitor the activities and results of initiatives arising from this conference;

(2) to promote exchange of information and technology relating to the and conservation of natural history collections;

(3) to work internationally to establish treaties so that in times of conflict, collections of natural history specimens are accorded equal protection with cultural artifacts. They must not be taken for trophy or ransom; and

(4) to collect documentation on the uses and benefits derived from natural history collections, and to update this documentation on a regular basis.

1-3 The WCCR is to promote international standards established by the International Commission on Zoological Nomenclature (ICZN), International Commission on Botanical Nomenclature (ICBN), Association of Systematics Collections (ASC), Society for the Preservation of Natural History Collections (SPNHC), American Society for Microbiology (ASM), etc., and similar organizations to ensure placement and long-term preservation of type and other voucher natural history specimens in appropriate institutions.

1-4 The WCCR will work with international organizations such as the International Council of Museums (ICOM) to promote high professional standards and establish educational programs for collection managers and conservators. This process will be aided by:

(1) providing museums and similar institutions with qualified consultants;

(2) helping with development of proposals for programs and funding;

(3) arbitrating conflicting opinions; and

(4) providing recommendations.

1-5 The WCCR, working with established organizations such as ASC and the Biology Curators' Group of the United Kingdom, will establish a network to monitor, assess, and assist collections at risk.

1-6 The WCCR will work with national organizations to help society understand the mission and value of natural history collections and the needs for professional care of collections, large and small, in perpetuity.

1-7 The WCCR will organize a meeting every four years for the purpose of:

(1) reviewing progression of the WCCR toward implementing the mandates of its mission;

(2) reviewing international progress toward preservation and conservation of natural history collections;

(3) providing a forum for presenting and discussing new conservation and storage techniques, and common problems, and making strategies to solve international problems; and

(4) giving a prestigious award, a medal, under the patronage of the Fundacion Cultural Banesto, to recognize outstanding contributions of individuals or organizations to the preservation and conservation of natural history collections and related issues.

ISSUE 2. FACILITY AND RESOURCE NEEDS FOR CONSERVING COLLECTIONS

As only approximately 10% of biological diversity is known to science of the 10 plus million species estimated to live on earth, and as efforts intensify to inventory earth's biological diversity due to the rapidly increasing species extinctions caused by man, collections are growing, and will continue to grow in size at a considerable rate. The tasks of conserving these collections in perpetuity likewise will increase. Currently there are insufficient collection spaces or facilities with appropriate environmental controls.

ACTION:

2-1 The Congress calls for rapid and focused surveys and inventories of the earth's biota realizing that the rate of man-related extinctions significantly decreases the diversity each year, and knowledge of the biota is the first step in understanding the function of biodiversity in ecosystems and its value to the human species.

2-2 This congress and the WCCR encourage institutional and societal policies that promote selective collecting of organisms, recognizing legitimate research needs and both the problems of the impact of collecting on species survival, and the problems of appropriate space for storage of specimens in perpetuity. The WCCR working with organizations such as the Sociedad para el Desarrollo de la Historia Natural will encourage the development of mechanisms to facilitate interactions between natural history collectors and those striving for the conservation of nature. The WCCR advocates salvaging of carcasses as a source of collection materials, selecting specimens where they are abundant, and establishing breeding stations (in situ or ex situ) as examples.

2-3 The WCCR will contact and interact with appropriate international bodies (ICOM, the United Nationals (UN), the World Bank, non-governmental organizations (NGOs), the European Community (EC), multinational corporations) to gain support to build, enlarge, and recondition natural history museums, and to provide appropriate facilities and resources based on a professional assessment of needs and long-range plans. Help is especially needed in developing countries.

2-4 The Congress recommends that a pan-tropical conference to be convened to define a strategic plan for small tropical museums and equivalent institutions, recognizing that such museums face extremely difficult physical and financial conditions as well as a growing need and responsibility to care for the rapidly increasing tropical natural history collections.

2-5 As national museums of natural history provide leadership for each country's efforts to understand its biological diversity and the sustainable use of its natural resources for their cultural and economic value, this Congress encourages countries without such institutions to form them. Furthermore, the Congress resolves that the WCCR will assist in providing models of organization and mission statements for new national museums.

2-6 The WCCR will aid regional and national collections care organizations to make national governmental agencies, NGOs, foundations, and the public aware of the need for new and/or enlarge/upgraded buildings, facilities, and resources for maintaining and preserving natural history collections in perpetuity.

ISSUE 3. MUSEUMS AND EDUCATIONAL NEEDS IN DEVELOPING COUNTRIES

The largest and longest established museums with collections housing millions of biological

specimens from throughout the world are situated in northern industrialized countries. The greatest proportion of biological diversity is found in developing countries with tropical rain forest. Also, there are other great centers of biological diversity and rich historic-cultural materials in developing countries. There are special needs to develop and maintain museums in developing countries. Scientists, scholars, and collection managers in developing countries require access to the large established collections.

Considerable international cooperation is needed with regard to collections access, training, data exchange, and technology transfer.

ACTION:

3-1 The WCCR will promote efforts to establish regional training centers in one or more developing countries, particularly in tropical regions, to train natural history museum collection managers and conservators to properly maintain collections in tropical regions. Support for such programs should be solicited from international organizations such as the UN, the World Bank, NGOs, and multinational corporations.

3-2 Aid is needed to provide scholarships and fellowships for students of developing countries to gain education in systematics, collection management and conservation in advanced centers in developed countries. Courses must be taught with recognition of the tools and technology that will be available to students when they return.

3-3 Industrialized and developing countries should be encouraged to form partnerships to build programs in collection management, and research on materials and methods for preservation. All countries should share information and improve access to scientific and world-wide cultural and natural resources.

3-4 International support should be sought to fund research on problems particular to specimen deterioration in tropical humid regions and to develop appropriate control measures.

3-5 In establishing partnerships between institutions of industrialized and developing countries, this Congress calls for bilateral cooperative programs that include technical, in-situ training. Managerial aspects should be carried out with great sensitivity and understanding of local conditions and constraints in the developing countries.

3-6 As most nations have little knowledge of their own flora and fauna, and as conservation managers and users of natural products require more complete inventories, we urge national governments to establish National Centers for Biodiversity that will set priorities, survey, study, document, and provide the public and policy makers with information about their national heritage. These centers should integrate existing efforts and support existing museums.

3-7 The Congress calls for greatly increased coordination among museum and other collection centers to provide a united thrust on the biodiversity crisis, including data and technology exchanges.

ISSUE 4. THE NEED TO ESCALATE RESEARCH AND DEVELOPMENT OF PRESERVATION AND CONSERVATION TECHNIQUES, AND RESEARCH IN COLLECTIONS CURATION ISSUES

Increasingly, numerous types of organisms, minerals and cultural materials may not ever be sampled again due to habitat destruction, restrictions on collecting endangered species or species from certain habitats, and cultural change. Furthermore, collections already contain records and specimens of species and populations that no longer exist. Accordingly, there is a need to escalate research and development in management and preservation techniques, as well as to provide a considerable increase in collection management education.

ACTION:

4-1 The Congress calls for an increase in educational courses and training programs at the undergraduate, graduate, and postgraduate levels for the following: collection management, specimen preparation and conservation, research in applied material science toward preservation and conservation of specimens. In education and training programs, existing methodologies must be adapted to local conditions in developing countries based on an understanding of the limitations constraints in such countries.

4-2 The WCCR will work with national collections care organizations, agencies, and private funding organizations to provide competitive program support for the education programs given above.

4-3 The Congress urges the WCCR to develop international cooperation, and to coordinate national and international initiatives aimed at specimen conservation with special reference to: preparation techniques, long-term storage techniques, repair and treatment techniques, disposal and destruction protocols, and conditions for loans and exchanges.

4-4 The Congress calls for increased application of technology that allows for extracting of data from specimens for research yet minimizes destruction of specimens.

4-5 The new molecular techniques are now of immense importance in systematics studies, thus the Congress calls on all curators, preparators, and collections managers to prevent the use of treatments that would irreversibly alter or destroy DNA content. Guidelines must be established to preserve useful DNA (and other genetic and biochemical materials) in new collections.

4-6 The Congress calls for increased research on collections to provide accurate identifications and to systematically update the collections, undertaking the steps necessary to provide accurate data to the user community.

ISSUE . THE NEED FOR TRAINED SYSTEMATISTS, COLLECTIONS MANAGERS AND CONSERVATION SPECIALISTS

As approximately 90% of biological species diversity is unknown to science, and as collection management for systematic research requires individuals who are authoritative concerning the systematics, taxonomy and nomenclature of genetically allied groups of species and genera, and as today there are too few experts for many groups, especially in taxon-rich developing countries, it is clear that there is an immediate need for the education and training of systematists with emphasis on studying the most poorly known group of organisms with the greatest economic and cultural value.

ACTION:

5-1 The Congress calls on universities to upgrade or establish programs in systematics and to form cooperative programs with free-standing museums and other collections centers in order to create strong programs for systematic research and for the training of systematists, collections managers and conservators, as well as administrators.

5-2 The WCCR is encouraged to work internationally to inform and educate pertinent national agencies and organizations about this pressing need and to work with them to form strategies for problem solving.

ISSUE 6. THE NEED FOR DATABASES

There are pressing demands for collection-based data. Collection management today requires

computerized data management. Increasingly, collection-based data includes information on how the specimens were prepared, the conservation status of the specimens, and actions taken to correct deterioration and damage problems. Effort is needed now to establish data standards and efficient exchange of data through networks within and between institutions.

ACTION

6-1 The WCCR will help facilitate exchange of information that builds on existing and successful data management systems, realizing that there have already been two decades of experience in computerization of museum collections.

6-2 The Congress calls for all natural history museums to work within existing programs to attain uniformity in data standards, to enhance data standards, to rapidly increase computerization of specimen-based data, and to establish protocols and safeguards for data exchange. It is necessary to establish linkages with other systems such as Global Information Systems, GenBank, the Conservation Information Network (CIN), and other networks.

6-3 The Congress calls for immediate action to rapidly create databases of all known species, including range and ecological data. To facilitate the process, the catalogue of the known biota of the world is to begin with minimal data (and thus will be necessarily crude). The estimated manpower for this task is 1.5 thousand person years at a cost of some 60 million pound sterling. This provides for what now is known of species diversity and numbers.

ISSUE 7. EDUCATION AND PUBLIC AWARENESS

Museums and other collection centers must become highly visible in the public eye if the energy of the people is to impel governments to act promptly to save the world's biota. Museums are ideally suited to establish strategies to create public and private awareness about the biodiversity crisis and the linkage between collections and our knowledge and understanding, use, and preservation of nature.

ACTION:

7-1 The Congress calls upon museums to change to an active outward-looking mode, and to build a solid contract with the public through relevant public education programs and exhibits using cultural values appropriate to the audience.

7-2 The Congress calls on museums to engage our systematics expertise and collection resources to address the crises of our day that endanger all the world's species. Relevant issues include the quality of environment, public health, useful genes/ gene products, global databases on species and habitat diversity, training specialists from developing countries, and providing a reference base for the inventory of flora and fauna of protected areas.

ISSUE 8. POSTAL SYSTEMS: RULES AND REGULATIONS

Museums today are faced with an ever-increasing burden of national and international rules and regulations that hinder the efficient and rapid flow of specimens and data for research and educational purposes. Frequently such rules and regulations cause considerable delays in delivery of specimens causing deterioration or destruction of the specimens.

ACTION:

8-1 The Congress calls for the WCCR to take the initiative to work and network internationally to derive

agreements, conventions, and treaties that will enhance the speed and efficiency of specimen and data flow, and enhance handling procedures for specimen care.

ISSUE 9. ENDORSEMENTS: UNESCO, UNCEDRIO

As these issues are of great importance to the good of the human species, and as there is a biodiversity crisis and a crisis in managing rapidly growing collection resources, the Congress requests that these issues and resolutions be carried to UNESCO to receive its endorsement. In so doing the Congress recognizes UNESCO's multiple mandate in the fields of education, science, culture and communications, and its long-standing experience in providing solutions to problems in environment and development, as well as its contribution to the protection and preservation of biological diversity. These resolutions are also to be carried to the United Nations Conference on the Environment and Development (UNCED) to be held in Rio de Janeiro in June 1992 to inform the Conference of these issues and actions deemed necessary, and to attain the endorsement of the Conference. This document is also to be carried to the World Conservation Union (IUCN) to obtain its endorsement.

"...collections have been assembled over several centuries, in many parts of the world, where they often document regionally characteristic organisms. Collections can document invasive species that increase in abundance or range over time. Likewise, collections can document the decline in so many species, and may even come to be the only places where extinct species exist." Peter H. Raven, Australian Biologist 5(1), 1992.

POST-POSTSCRIPT

Contributed by **Dr. G.G.E. Scudder**

A more recent Resolution was passed at a Joint Meeting between Agriculture Canada, Forestry Canada, and the Canadian Museum of Nature held in Ottawa, June 15-17, 1992:

RESOLUTION

Whereas biosystematics is the scientific study of the identities, nomenclature, relationships and classification of organisms, and is essential for the assessment, conservation, and sustainable use of biological diversity:

As an initial response to our National and International obligations stemming from the Biodiversity Convention signed at the Earth Summit in Rio de Janiero, Canada should establish a National network linking existing biosystematic expertise, collections and research capabilities in Federal and Provincial agencies, museums and universities. This should involve a comprehensive analysis of existing capabilities, leading to development of a plan to ensure that requirements for biosystematic information can be adequately met.

Science

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Science and technology in Canadian museums : a ne
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Canadian
Museum
of Nature

Musée
canadien
de la nature

Science and Technology in Canadian Museums documents major concerns and vital recommendations for Canadian museology, both today and for future generations.

The workshop, held 19 and 20 March 1987 in Hull, Québec, was created to explore problems perceived by many museum experts, and addresses both ongoing and future issues that affect museums. Some of the contributors include: R. Yorke Edwards, Alan R. Emery, Leslie H. Patten and Jean-Pascal Souque.

ISBN 0-660-13068-8